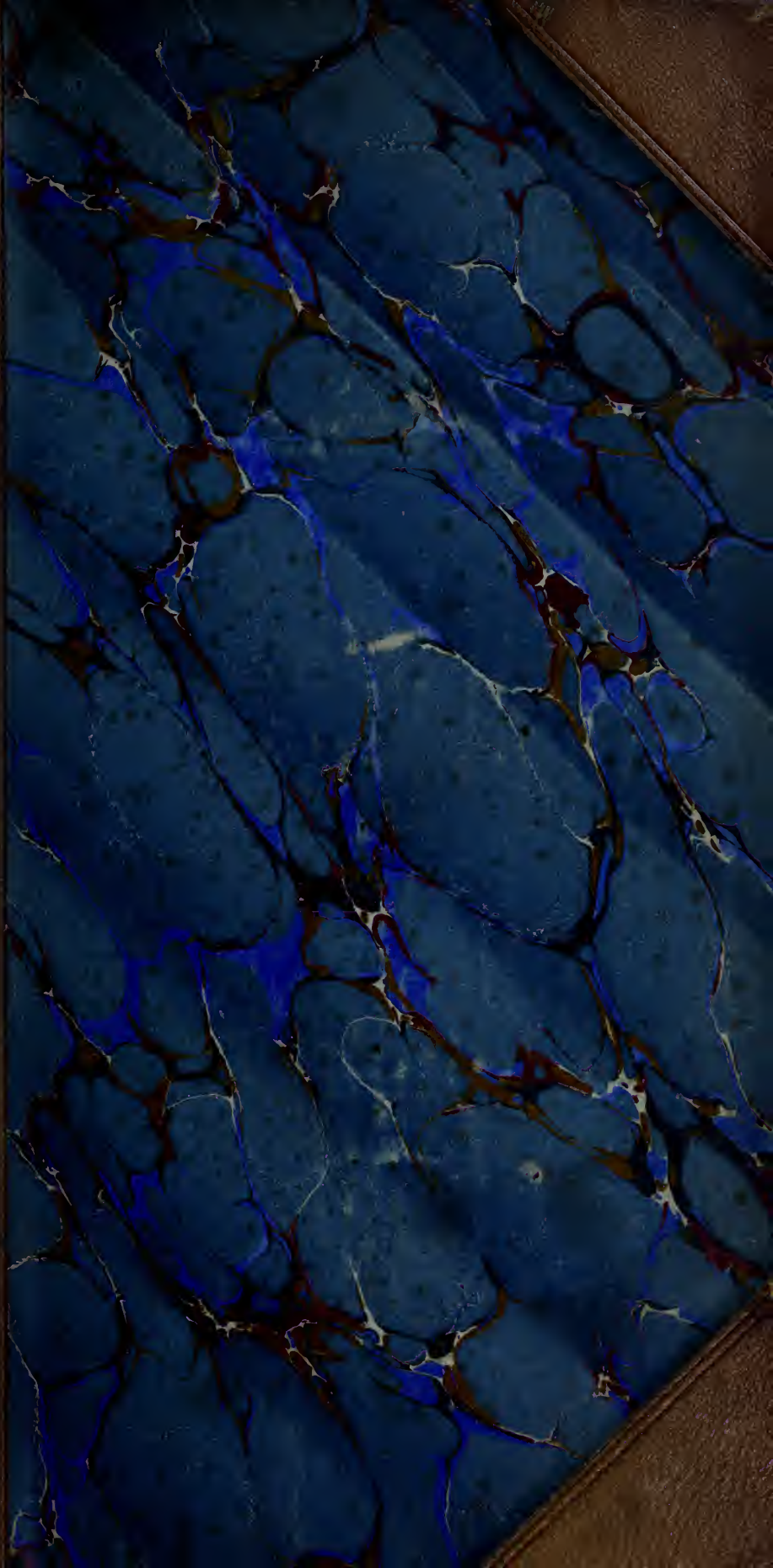

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THE LOCAL GOVERNMENT BOARD.

REPORTS AND PAPERS

ON

CHOLERA IN ENGLAND IN 1893;

WITH AN

INTRODUCTION

BY THE

MEDICAL OFFICER OF THE LOCAL GOVERNMENT BOARD.

Presented to both Houses of Parliament by Command of Her Majesty.

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PUBLIC HEALTH.

REPORTS AND PAPERS

ON

CHOLERA IN ENGLAND IN 1893.

SUBMITTED BY THE MEDICAL OFFICER

OF

THE LOCAL GOVERNMENT BOARD,

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REPORT.

TO THE RIGHT HONOURABLE THE PRESIDENT OF THE LOCAL GOVERNMENT BOARD.

SIR,

I BEG leave to submit to you, for presentation to Parliament, the following report on cholera in England during 1893.

In my last report, which dealt with the proceedings of your Medical Department during the year ending Lady Day, 1893, I gave an account of the European epidemic of cholera during the year 1892, and I reported that, although 35 cases of cholera had reached our shores between August 25th and October 18th of that year, the disease had in no case extended to any person beyond those arriving from abroad.

This result, eminently satisfactory in itself, was not one which, under the then existing circumstances of Europe, could well be expected to repeat itself if cholera broke out anew in the following year; and it was because of apprehensions of such recrudescence and of the strain to which our sanitary organisation, whether along our coast line or inland, would thereby become subjected, that I urged upon the Board the institution of the Cholera Survey and that increase in the staff of the Medical Department to which I have already referred in my last report.

The risk to England, in regard of cholera during 1892, had been in one sense limited by the concurrent operation of two factors. In the first place the disease, having travelled step by step across the continent of Europe, only reached our shores somewhat late in the season at which cholera most readily becomes epidemic in this latitude. And secondly, the imported disease reached us direct from places, such as Hamburg, where it was in full vigour, and where the majority of persons who received the infection might be expected, on arrival in this country, to develop symptoms sufficiently typical of cholera to admit of the early recognition of the disease. But, in urging the adoption of special measures of precaution in anticipation of cholera in 1893, I took occasion to point out that if, with the advancing summer, recrudescences of the disease should take place in the ports and towns along the western littoral of the continent of Europe, we might have to face the risk of a series of importations extending over several months, instead of several weeks, of that period when cholera has, aforetime in England, tended to assume epidemic proportions. And not only so; I also expressed the opinion that if the cholera reached us in the early stages of any recrudescences in Western Europe, we should be exposed to the risk of the importation of mild attacks of the disease which it might be difficult to differentiate from attacks of that summer diarrhœa which is commonly prevalent with us year by year.

Cholera in England in 1893.

Happily there was not, in the spring and early summer of 1893, anything that can be regarded as an epidemic recrudescence of cholera in those places in western Europe where the disease had been prevalent in the summer and autumn of 1892. Even Hamburg, for the first time in the history of its epidemics, escaped a second year of cholera; a result that must, in the main, be attributed to the provision of new works of water supply for the city, works which were set up by immense labour and completed with a rapidity almost, if not altogether, unexampled. Cholera was, as a matter of fact, recognised in English ports and towns at a distinctly earlier date in 1893 than in the preceding year, but the number of such cases hardly exceeded a dozen before the end of August.

But if my surmise as to early importation of cholera into England in 1893 failed to be fully realised, the failure seems to have been more in appearance than in fact; since such importation was in all probability obscured by reason of the occurrence of that second source of danger to which I had adverted, namely, the arrival of the disease in a phase when its true nature did not admit of early recognition. The story of cholera in the ports at the Humber mouth is, in truth, a story of cholera the first beginnings of which were clouded and obscured by attacks first regarded as diarrhœa, which was next looked upon with grave suspicion and called by such names as choleraic diarrhœa and cholera nostras, and was finally recognised to be true cholera.

The history of cholera in England in 1893 is embodied in a series of reports, which I submit in Appendix. The first is a general report on the cholera prevalence as a whole by Dr. Barry; then follow a number of reports on special occurrences of the disease which called for local investigation by the Board's Medical Inspectors; and the last contains an account of the bacteriological studies by Dr. Klein of certain material derived from individual cases of disease that was submitted to the Board for examination.

The first definite importation of cholera into England in 1893 took place in the Tyne port, where a vessel hailing from Nantes arrived on June 25th with the body of a man who had died a few hours before from that disease. No further importation was recognised until July 18th, when the Cardiff Port Authority found it necessary to isolate two convalescing cases which had arrived by ship from Marseilles. Two days after, a case of cholera reached the port of London in a vessel from Marseilles and Havre; the actual nature of the attack being confirmed as the result of bacteriological examination by Dr. Macfadyen; and on the 24th of July a vessel from St. Petersburg, which had touched at Dieppe, brought two men into Liverpool port whom it was found necessary to remove to hospital on account

of symptoms of cholera. These, with one secondary case, making a total of seven, were all the attacks known of in England up to the end of July; they were all brought from abroad into our port districts; and it is worthy of record that in these cases, and, indeed, as regards 11 out of the total of 13 cases in which cholera was detected in our port towns during 1893, no extension of the disease to any person other than those who had arrived from abroad took place.

Dr. Barry's report (Appendix A., No. 1) gives a summary account of disease reputed to be of the nature of cholera which took place in England in 1893. In all, 64 separate localities, of which 15 were metropolitan sanitary districts, were involved. Exclusive of the few ship-borne cases, the total number of attacks was 287, and of these 135 terminated fatally. But of the 64 localities referred to, there were no less than 42, including 14 metropolitan districts, in which only single attacks were heard of. In only one metropolitan district did the number of these reputed cholera attacks reach three; and taking England and Wales as a whole, there were only five localities in which the attacks exceeded 10 in number.

If Dr. Barry has erred, it has not been in the direction of understating the number of reputed cholera attacks in England; on the contrary, he may be regarded as having included some cases which might properly have been eliminated from his list. Indeed, the antecedent and clinical histories of some of the cases in question are such as, in themselves, to raise doubt whether the attacks were true cholera; and the great excess of instances in which a first case remained a solitary one, tends at first sight to emphasise that doubt. But on the other hand, it must be noted firstly, that, taking all the attacks together, the fatality rate reached 47 per cent.; secondly, that in 35 of the 42 single attacks death ensued; and thirdly, that in several of these isolated attacks material submitted for bacteriological examination to different experts gave positive evidences of true cholera. Indeed, I am of opinion that the circumstances attaching to these solitary attacks, as also to a number of others where two or three attacks followed each other in such rapid sequence as to amount in fact to a single manifestation of the disease, do credit, in the majority of cases, to our English system of public health administration. Where the case is the reverse, I shall not fail to indicate it.

As regards a number of cases which were made the subject of special investigation by one or other of the Board's Medical Inspectors, I would now make the following further remarks.

Local Manifestations of Cholera and Reputed Cholera.

Cholera at:—(*a.*) Great Grimsby and Cleethorpes.

The earliest indication of a cholera prevalence in England during 1893 took place in the town and port of Great Grimsby

and the adjoining sanitary district of Cleethorpe-with-Thrunscoe, both situated on the southern shore and near the mouth of the Humber. On August 21st, the Board were informed by the local Medical Officer of Health of these districts, that three deaths from "cholera nostras" had occurred between August 11th and 20th, it being added that in one of the cases the medical practitioner in attendance, who had certified the death as due to "cholera nostras," had referred to the symptoms as being those of Asiatic cholera. Towards the close of the month deaths registered as due to cholera nostras, choleraic diarrhœa, and diarrhœa, became more numerous in Grimsby, and Dr. Reece was instructed to visit the borough without delay. His report, which deals with both Great Grimsby and with Cleethorpe-with-Thrunscoe, commonly known as Cleethorpes, will be found in Appendix A., No. 2.

Directly the matter was investigated, it transpired that disease of a choleraic character had been prevalent and fatal in Grimsby ever since the beginning of the month of August. Thus, a man who had arrived in Grimsby port on August 2nd, on board the SS. "Dania," from Antwerp, and who had died the following day of "choleraic diarrhœa" in the Port Hospital Ship, had been buried with precautions—including the wrapping of the body in sheets soaked in carbolic acid, and the surrounding of the coffin with quicklime—such as are sufficient to indicate that grave suspicion was locally entertained as to the real nature of the disease in question. On August 11th, there was a fatal attack styled "cholera nostras" in the town itself, and by August 30th there had been no less than 15 deaths of a similar character, 14 of which had occurred in the town, There had also occurred a fatal attack, registered as due to "cholera nostras," on August 15th, in a suburb of Grimsby, but just within the jurisdiction of the Cleethorpes Urban Authority. But not until August 31st, two days after Dr. Reece's arrival in Grimsby, was the first certificate of death indicating the presence of true cholera issued. In Cleethorpes, where four more fatal attacks of "diarrhœa" or of "choleraic diarrhœa" took place between August 27th and September 2nd, the first death referred to "cholera" was so certified on the last-named date. Reviewing the circumstances in the light of subsequent knowledge, it appears that, in addition to the death of the man removed from the SS. "Dania," cholera caused, in Great Grimsby, 15 deaths in August, 18 deaths in September, and 2 in October; and that there were in Cleethorpes, 3 fatal attacks in August and 4 in September, making 43 deaths in all in these two adjacent places.

Directly it became evident that cholera was prevailing in Grimsby and Cleethorpes, the Board, acting under the powers conferred upon them by section 134 of the Public Health Act, 1875, issued an Order declaring certain epidemic regulations to be in force within these districts. This Order was issued on September 1st, 1893, and it was followed by a supplemental

Order on September 6th. Both these Orders are reproduced in Appendix A., No. 17. The regulations embodied in the Orders required the division of each of the urban sanitary districts into "sub-divisions," the appointment of medical visitors and assistants in each sub-division, the daily visitation of localities inhabited by the poorer classes, the gratuitous supply of medicines, medical aid, and nursing, the isolation in hospital or otherwise of the sick, the speedy burial of the dead, together with the adoption of measures of cleansing and disinfection wherever these were needed. Choleraic diarrhœa as well as cholera was, for the purposes of the regulations, declared to be a notifiable disease, and a daily record giving particulars as to cases of these maladies was ordered to be transmitted to the Board. These Orders remained in operation until January 8th, 1894.

The beginning of cholera in Grimsby and Cleethorpes is involved in considerable obscurity. With a view to its elucidation, Dr. Reece traced the antecedents of a number of persons by whom the disease might have been imported by sea during the first days of the month of August, but the materials collected failed to afford any satisfactory solution of the difficulty. When, however, notification of "diarrhœa" was instituted by the Grimsby and Cleethorpes Sanitary Authorities, it was found that this disease, under the designation of which certain fatal attacks, which must be regarded as cholera, were registered, had become very widely prevalent in both places. "Diarrhœa" was also causing a large mortality. Indeed, the diarrhœa death-rates of Grimsby and of Cleethorpes during the third quarter of 1893, were out of all proportion to those of the large towns and cities of England during the same period, and they very greatly exceeded the corresponding rates which had obtained in those districts in antecedent years. And when the details of fatal "diarrhœa" in Grimsby came to be examined more minutely, it further transpired that the excess of death registered under that heading had commenced about mid-July; that 29 fatal attacks had occurred in the four weeks ending August 5th; that in the next five weeks, during which cholera was most prevalent in the borough, no less than 81 deaths were ascribed to diarrhœa; and that taking the period August 5th to October 14th, during which period disease of the nature of cholera attacked 127 persons and caused 35 deaths in Grimsby, there were 89 fatal attacks assigned to "diarrhœa." Thus, prevalence of cholera both in Grimsby and in Cleethorpes occurred simultaneously with an epidemic prevalence of diarrhœa; and, in Grimsby at least, it was preceded by an ominous increase of mortality referred to that cause. This is but a repetition of that which has so often occurred before in the history of cholera; and it can hardly be doubted that cholera had made its way into Grimsby and Cleethorpes sometime before the fact was recognised, and that the disease secured a footing in those towns, for want of the adoption of adequate measures of prevention at an early stage. Such measures as were carried out during the month of August, came too late to prevent

the spread of an infection which had by that time had ample opportunity for diffusion. The true character of this early diarrhœa was later on significantly illustrated, when "infective diarrhœa" spread amongst the shipping in two of the docks in sequence to the occurrence of illness on board a vessel which was certified to be infected with "cholera."

In dealing with the local conditions which in Grimsby may have served to facilitate the spread of cholera when once introduced, Dr. Reece is able to eliminate the public water service; but he attaches importance to the influence of the faulty conditions of sewerage and drainage. Indeed, in Grimsby one of the advantages usually claimed for the "water carriage" system, namely, that of the rapid removal of excreta from the proximity of dwellings, is to a large extent frustrated. This result is mainly due to a practice by which so-called "cesspools" are constructed along the line of the house drains, in such a way that solid filth and refuse are retained on or near domestic premises instead of being carried away to and by the sewers; and, incidentally, there ensue local nuisances from foul effluvia, and not unfrequently soakage of filth, including specific filth, into the superficial soil. Such conditions, when coupled with the damming back of sewage in the sewers by tidal action for a large part of each 24 hours, are precisely of a kind which have commonly been associated elsewhere with excessive prevalence of "filth disease"; and, apart from the cholera and diarrhœa already referred to, it is noteworthy that during the period July 29th to November 4th, 1893, no less than 260 cases of enteric fever, with 41 deaths, were recorded in Grimsby. The distribution in Grimsby of 127 attacks of cholera, choleraic diarrhœa, and cholera nostras, and of 326 cases of enteric fever during 1893, as also of 451 attacks of "diarrhœa" in the single week, September 6th–12th, is shown by Dr. Reece in a series of charts. The tendency of these three filth diseases to especially affect the same localities deserves the careful attention of the Local Sanitary Authority.

The Grimsby sewage is ultimately discharged by means of two outfalls, under circumstances which admit of its being washed back over oyster, mussel, and cockle beds. To this disposal of the sewage in connexion with the cultivation of shell fish, and its possible relation to the diffusion of cholera, I shall refer again.

(*b.*) Hull. On the 24th August a first case of cholera was recognised in Hull. This case, which terminated fatally, was clinically one of a very suspicious character; moreover, the materials examined gave unequivocal bacteriological indications of true cholera. The previous history of the patient, a boy of 11 years of age, afforded no actual proof as to the source of the infection; but it is known that he sickened 16 hours after swallowing some exceptionally foul water in which he was bathing, and that of six of his fellow bathers, no less than five suffered from nausea, or vomiting, or diarrhœa. The water in

question is known to have been befouled by sewage, and one sample of it revealed the presence of Koch's typical comma-bacillus. Having regard to these circumstances, and to the fact that this case was followed by 11 other fatal attacks of cholera during the month of September, much interest attached to the history of Hull in regard of cholera or choleraic diarrhœa, both antecedent to, and at the time of its first recognition in the borough; and this subject is dealt with in considerable detail in Dr. Theodore Thomson's Report (Appendix No. 3). By the aid of compulsory notification returns, of other and voluntary returns, and of death certificates, it was ascertained that Hull early in September passed through an exceptional prevalence of diarrhœa, some of the attacks being "choleraic"; that the diarrhœa death-rate for the borough during the third quarter of 1893, was greatly in excess of that for the large towns and cities of England, and nearly three times as great as the average decennial rate for Hull; that between September 2nd and October 11th, there were 152 attacks of "choleraic diarrhœa," of which five terminated fatally; and that the incidence of this choleraic diarrhœa was, unlike that of ordinary summer diarrhœa, essentially on persons coming within the age-group 15–60 years. It was also ascertained that in addition to diarrhœa antecedent to the 24th of August, one very suspicious attack, involving cramps, vomiting, and purging, had occurred in an adult on August 16th. The story of cholera in Hull is therefore complicated by a considerable prevalence of diarrhœal disease, much of which was of a highly suspicious nature; and is entirely consistent with the view that cholera had been introduced into the borough in a form in which it at first failed to be recognised. The persistence both of cholera and of choleraic diarrhœa in the borough can harly be dissociated from conditions involving the pollution both of soil and air; and it is noteworthy that the localities which suffered most from cholera and choleraic diarrhœa, are also those in which an exceptional excess of diarrhœa and of enteric fever were most marked. The sanitary circumstances of Hull evidently leave much to be desired; and had it not been for the exceptionally high standard at which the sanitary service of the borough is maintained, cholera would probably have found in those circumstances a means for a wider diffusion of its infection than was witnessed.

(c.) Rotherham.

The first recognised attack of cholera in Rotherham took place on September 5th: the patient died within 14 hours of his initial symptoms. No complete clinical record of the case was, under the circumstances, forthcoming, but bacteriologically the case was pronounced to be indistinguishable from true cholera. A second attack, also fatal, took place on September 11th, and this was followed by a third non-fatal attack on October 18th. These two later attacks were clinically regarded as due to true cholera; and with the first-named one they were the only cases which at the time were recognised and certified

as "cholera." But on September 10th, "diarrhœa" was added to the list of notifiable diseases in the borough, and several important points were elicited as the result of this action. First was the fact that 18 cases certified as "choleraic diarrhœa" took place between September 15th, on which day four such cases were notified as then existing, and October 18th. Secondly, in two of the cases of choleraic diarrhœa, which occurred early in October, and of which one was fatal, bacteriological examination of the intestinal discharges showed that these attacks were, like the first recognised case, indistinguishable from "cholera." Thirdly, the notification returns of diarrhœa also went to show that 402 attacks returned under that heading took place in the seven and a half weeks September 10th to October 31st; 150 being notified in the the first seven days and 86 in the second seven days of that period. Fourthly, the mortality returns showed that during both the second and third quarters of 1893 the death-rate from diarrhœa in Rotherham considerably exceeded the mean of previous years, that it was far higher than that of other large towns in England and Wales, and that in the third quarter it reached 6·74 per 1,000 living, whereas it hardly exceeded 3·5 in 100 "large towns" grouped together, and was only 2·8 in England and Wales as a whole. And lastly, when judged by the mortality returns, it was seen that diarrhœa was more prevalent in Rotherham both during July and August than it was in September, when cholera and choleraic diarrhœa were first recognised. But any significance which might otherwise attach to this excess of death from diarrhœa in Rotherham during the second and third quarters of 1893, can be thought of as largely discounted by the fact that the incidence of this mortality was, as in ordinary years, essentially on infants and old people. Indeed, no death from diarrhœa occurred over five years and under 60 years of age.

With regard to the causation of this choleraic outbreak, no satisfactory solution could be found. The water supply of the borough, to which I referred in my last annual report, remained open to contamination, and the soil on which the town lies was found to be exposed to fouling by soakage of filth, but neither these circumstances nor any others that were discoverable threw any light on the origin or subsequent distribution of the cholera or the choleraic diarrhœa in question. And, when the occurrence of disease of a like sort, antecedent to September, came to be investigated, nothing more definite could be discovered than the fact that a woman who with several friends had been at Grimsby and Cleethorpes on the preceding day, had rapidly succumbed to some undefined but fatal illness, associated with collapse, on August 24th. This woman alone, amongst the party of whom she formed one, had partaken of oysters on the sands at Cleethorpes. Dr. Theodore Thomson's Report on this outbreak will be found in Appendix A., No. 4.

On September 4th, a publican's widow, residing at Middleton, in Lancashire, who had had antecedent diarrhœa, was seized with a fatal attack which in many important respects, including profuse watery evacuations, sub-normal temperature, suppression of urine, and collapse, resembled cholera. She died in 14 hours, her death being certified as due to "choleraic diarrhœa." When the details of the case were subsequently investigated, nothing could be elicited to connect the attack with any former occurrence of cholera. Four persons were present during the preparation of this woman's body for burial, and within 32 hours of so doing, one of these, an aged woman, was seized with similar symptons and died in 12 hours. Her death, which took place on September 7th, was certified as due to "cholera." On the same day a third adult woman assisted in laying out the body of this old woman, and in emptying out a flock bed which had been saturated with her discharges. This third woman sickened next day. She suffered from symptoms such as profuse watery diarrhœa, vomiting, cramps, and sub-normal temperature, but she recovered. Her attack was notified as one of "cholera," but it was subsequently explained that it had been looked upon as a case of "English cholera." On these occurrences becoming known to the Board, Dr. Sweeting immediately visited Middleton, and he there ascertained that the group of cases referred to had been preceded by two others: one involving an attack of fatal "English cholera" in a woman on July 7th; and the second, a fatal attack, which set in on August 22nd. This latter case was that of a woman, who suffered from violent watery purging, cramps, and vomiting, and who fell into a lethargic state and died on August 27th. Her husband had previously suffered from severe diarrhœa. Dr. Sweeting only reached Middleton in time to see one of the patients, the one who recovered after sickening on September 8th; but, as he points out, an occurrence associated with symptoms such as those which he relates, and involving the death of four out of six adults attacked, has not hitherto been known in this country apart from true cholera infection. Such other sickness as was heard of in Middleton consisted of minor diarrhœal attacks simultaneously affecting relations and neighbours of certain of the deceased. In no case was bacteriological investigation resorted to. (Appendix A., No. 5.)

(*d.*) Middleton.

On September 7th, a fatal attack, certified as due to "choleraic diarrhœa—cholera," took place in the person of an adult female residing in the parish of St. Margaret and St. John, Westminster. The woman in question was employed as a "cleaner" in the House of Commons, and it was there that she was attacked with severe abdominal pain, vomiting, and profuse diarrhœa on September 5th. Returning to her home she suffered from frequent and copious rice-water stools, cramps, blueness of extremities, sunken eyes, livid complexion, sub-normal temperature, intense thirst, diminution—if not suppression—of urine,

(*e.*) Westminster (London).

and collapse, which terminated in death during the night of September 6th–7th, within 40 hours of the commencement of the attack. The clinical features of the disease were those of true cholera, and bacteriological investigation of the rice-water stools and of a piece of ileum, revealed in typical and pronounced form conditions which, according to Dr. Klein, were "absolutely typical of a pure case of Asiatic cholera." The principal interest of this case lay in the obscurity of its cause; indeed, the only point that seemed in any way to be related to the woman's illness, was the fact that she and her two daughters suffered from diarrhœa and abdominal pain on September 4th, after having eaten the remains of some pickled pork and rabbit which had been purchased two days before; but owing to the extremely retiring habits of the woman, her history immediately antecedent to her attack was involved in much doubt. Dr. Sweeting's report on the circumstances of the case, as also Dr. Copeman's account of the measures of cleansing and disinfection that were carried out in the House of Commons, are reproduced in Appendix A., Nos. 6 and 7.

(*f.*) Ashbourne. (Derbyshire)

On September 6th, a localised but very severe and fatal outbreak of cholera commenced at Ashbourne, in Derbyshire. According to Dr. Bruce Low's Report (Appendix A., No. 8), the attacks were limited to a single yard behind the "Coach and Horses" Inn, where, out of a total of 39 inhabitants living in eight houses, there were in seven days no less than 15 cases of cholera, with nine deaths. The symptoms were typical of cholera; they included violent vomiting, profuse diarrhœa with "rice-water" stools, cramps, sub-normal temperature, more or less suppression of urine, collapse, and rapid death. In one of the fatal cases, bacteriological examination of a portion of the ileum gave positive indications that the disease was true cholera. The interest of the Ashbourne cholera story lies largely in the circumstances with which the outbreak was associated. The yard itself abounded in those conditions which are notorious as favouring pollution of air, soil, and water, by reason of emanations from and soakage of filth. The "Coach and Horses" received lodgers of a very low class, including hawkers and other nomadic folk, and Ashbourne "wakes," when many persons of the itinerant class visit the township, had only recently come to an end. Inside the inn, and situated against one of its outer walls, was a hand-flushed watercloset, having a broken soil-pipe; close by was an outside urinal, which also served on occasion as a closet, as also a gully which was at times made the receptacle of excreta. In immediate proximity to these was sunk the well which supplied the yard with water. The subsoil was porous; it was saturated with excreta, which had escaped through the defective soil-pipe of the "Coach and Horses" closet, to within 18 inches of the well; and it was fouled besides by reason of the filth from the urinal and the gully. The first recognised attack was that of the landlady

of the inn itself, and her discharges were so disposed of that they cannot but have reached the well, the water from which was found to be "teeming" with comma-bacilli. These, on further investigation, were found "morphologically and "culturally identical with those obtained from the discharges of "cholera patients." This woman's case was probably preceded by some unrecognised attack in one of the many wanderers who had recently frequented the inn. Of the eight households resorting to this well, six were invaded with cholera, and the further progress of the disease was only stayed by stopping the use of the well water, and by filling in the well with quicklime. This latter step was taken on September 12th; but before this, two severe attacks of "diarrhœa" in persons residing outside the precincts of, but close by, the "Coach and Horses" yard had occurred.

Ashbourne, lying near the Derbyshire Dales, is a place which is largely frequented by visitors, but its sanitary traditions are in some respects eminently unsatisfactory. When diphtheria was prevalent and unduly fatal there some six years ago, Dr. Bruce Low, in reporting to the Board on its sanitary circumstances, took occasion to condemn its water supply; and in dealing with the pollution of the shallower private wells by means of dung-heaps, pigstyes, and collections of animal filth, he pointedly referred to the pump in question as one sunk close by the "urinal attached to a public-house," whence there was soakage "through the unpaved and unprotected yard above the "shallow well."* On receipt of this report, which was communicated to the Authority, the Board urged upon that body that they should secure a supply of wholesome water adequate to the requirements of their district. The answer received stated, amongst other things, that the Local Board "consider "that the town is as well supplied with water as the majority of "other towns in the country." Thenceforward, evidence went on accumulating as to well pollution in Ashbourne and as to the need for a proper water service, and both the Medical Officer of Health for the district and the County Health Officer expressed themselves strongly in this sense. In view of the prospects of cholera, Ashbourne was chosen by the Board as one of the localities calling for special visit on account of its well known sanitary shortcomings. Hence in June 1893, before the appearance of cholera in England, Dr. Maclean Wilson was instructed to inspect the district. On this occasion he once more drew attention to the need for a water supply that should not be subject to the risk of pollution, and he recommended action without delay. He also made special comment as to the condition of the yards within the town. Following on this, a public notice was issued by the chairman of the Authority requesting householders and ratepayers to record their opinion

* Report by Dr. Bruce Low on Diphtheria in Ashbourne Urban Sanitary District, page 75 of Report by the Medical Officer of the Local Government Board for 1888 (C. 5813-1), 1889.

as to a scheme of water supply which had for some time past been in contemplation, and this notice at last admitted that the existing water was "both impure and insufficient." But when cholera invaded the place in September, Ashbourne still retained its polluted wells; and a section of the population was still actively opposing the new scheme for a public water service. Immediately following on the cholera outbreak, formal application was made by the Ashbourne Local Board of Health for sanction to a loan to provide a complete system of water supply, but the scheme had ultimately to be abandoned owing to legal difficulties. Preliminary action is now being taken with a view to an alternative supply.

This history of cholera in the "Coach and Horses" yard, at Ashbourne, recalls the worst we have ever known of cholera in this country. On a small scale it exemplifies, in September 1893, much as the history of Hamburg did on a large scale in 1892, how potent for mischief and for death is a water so circumstanced as to become specifically polluted by cholera discharges. It recalls the outbreak which, in 1854, was caused by water from the pump in Broad Street, Golden Square, and which Dr. Snow has made historic in the annals of English cholera; and it vividly reminds us that the words used more than 30 years ago by my predecessor, Sir John Simon, to the effect that "excre-" ment-sodden earth, excrement-reeking air, excrement-tainted " water, these are for us the causes of cholera," hold good now just as they did then.

(*g.*) APPLETON-LE-STREET. (*Malton R.S.D.*)

Another localised outbreak, which must be regarded as one of cholera, occurred in the village of Appleton-le-Street, in the Rural Sanitary District of Malton, Yorkshire. The circumstances which were investigated by Dr. Copeman (Appendix A., No. 9) were as follows:—

A small freeholder of intemperate habits, who had been staying a week at Scarborough, fell ill on his journey home on the night of September 6th. Having arrived at his house at Appleton-le-Street, he suffered from profuse diarrhœa, collapse, and severe cramps; he then became pulseless, with sunken eyes and blue lips, his limbs were icy cold to the touch and, after continuously passing watery evacuations of a milky appearance, he died early on September 10th. The sequel to this case ultimately brought the circumstances under the notice of the Medical Officer of Health, who communicated with the Board. A married sister of the dead man came from Terrington to Appleton, a distance of some six miles, to attend his funeral, and, after staying in her late brother's house for two days, was seized with diarrhœa and cramps. Her condition was critical for some days, but she ultimately recovered. The father of the dead man's widow also came from Terrington and attended the funeral on September 12th, and he returned to the house at Appleton again on the 18th. On the 19th he, too, was seized with profuse diarrhœa, vomiting, and cramps; the discharges were watery, with whitish

flocculi; and within four-and-twenty hours of his attack he sank and died on the 20th. The first patient's widow slept on the night of the 18th in the bed in which her husband had died, the bed clothes, which had been saturated with his discharges, having only been dried. Next day she was attacked with very similar symptoms; in her case the stools were of the typical "rice-water" character. She also died on the 20th, within 12 hours of her father. In this case microscopical and bacteriological examination of a portion of the lower intestine gave results which were typical of true cholera. A niece of this woman had not only been residing in the house at Appleton, but had shared with her the dead man's bed on the 18th of September, and this girl next sickened. Being a deaf-mute, no details of her case were procurable beyond the fact that after her return to Scarborough, on September 21st, she had sharp diarrhœa with pain about the body. She ultimately recovered. No illness could be heard of at either of the places from which those persons came who attended the first patient's funeral. The only circumstances they had in common were their stay in his house at Appleton and their rapid seizure with choleraic symptoms. Built on to the wall of the Appleton house and adjacent to the larder was the privy belonging to the dwelling, and this privy had received the owner's bowel discharges. The water supply, which was imperfectly protected against surface pollution, was found to be organically impure; but at the date when it was examined no proof could be obtained of its having become infected with the cholera organism. The history of the five attacks, of which three were fatal, pointed first to infection imported into Appleton, and then to its subsequent communication to all of the dead man's relations who had stayed in his house. In seeking some clue as to the cause of the first attack, it transpired that, with one exception, the food supplies which the six inmates of the house at Scarborough, in which the man in question had stayed, had been common to the whole household. The exception was that the man who had sickened on his way home to Appleton had partaken freely of oysters, which had almost certainly been derived from Cleethorpes. He alone had eaten oysters, and he was the only member of that household who suffered from any diarrhœal symptoms.

(*h.*) Morton and Owston Ferry. (*Gainsborough R.S.D.*)

On September 7th, an adult male, residing in the village of Morton, situated on the right bank of the Trent, in the Gainsborough Rural Sanitary District, was suddenly seized with symptoms identical with cholera. He died within 19 hours of his attack, and bacteriological examination of a portion of his ileum gave distinct indications of true cholera. A son of the man in question returned to Morton on August 31st with a halibut which he had purchased in the docks, at Hull, and the fish was eaten by the family, consisting in all of five adults, on the same evening. Next day the mother was attacked with diarrhœa, which lasted until September 5th; and on the morning

of the 7th, the father—who, as already stated, was fatally attacked that day—had taken part in emptying the midden-privy which had received the alvine dejections of his household, including those of his wife. In this work he was assisted by two of his sons, one of whom was attacked with diarrhœa onthe 10th. The son who had been in Hull had, so far as could be gathered, not suffered from any diarrhœa. But, having regard to the cholera which prevailed in Hull at this date, the fact that three diarrhœal attacks, of which the central one in point of time gave proof of being cholera, occurred in this family of five people, one of whom had recently arrived from Hull and had brought fish from that place, cannot be ignored in connexion with the disease which followed. But Dr. Bruce Low, whose report is appended (Appendix A., No. 10), shows that there had been antecedent attacks in this rural district. In the village of Owston Ferry, which lies some eight miles to the north of Morton, on the opposite bank of the Trent, and where "summer diarrhœa" is rare, there had been fifty or more attacks of "diarrhœa" and six fatal attacks of "choleraic diarrhœa" between July 31st and September 14th. So also in the little village of Susworth, somewhat lower down the river and on its right bank, there were cases of "choleraic diarrhœa" during September. The Trent, which is polluted with sewage, has for some time past been under suspicion by the Board as a source of water supply; but of the persons fatally attacked in Owston Ferry only two could be learned to have used this water. On the other hand, people in Owston Ferry have frequent and intimate communication with Hull, and Hull people come to Owston Ferry as visitors. One Hull visitor, arriving about mid-August, had diarrhœa several days after reaching the village. The sewerage arrangements of Owston Ferry are precisely such as would serve to spread disease associated with alvine discharges of a specific type.

(i.) Great Yarmouth.

A report by Dr. Copeman on a series of four cases of suspected cholera at Great Yarmouth will be found in Appendix A., No. 11. Only the last of these came under Dr. Copeman's personal observation; the history of the three previous attacks being elicited after their termination. The first case which aroused any suspicion on the part of the local sanitary officers occurred in the person of an adult itinerant who at the time had frequented a common lodging-house in the borough. The attack, which was reported to the Medical Officer of Health on September 8th, was one of severe diarrhœa with cramps, which, after removal to hospital, speedily ended in recovery. The case was notified as one of "English cholera," and at the date of Dr. Copeman's inquiry no evidence was forthcoming to show that the case had been of the Asiatic type. The second case occurred in the well-known "Rows," the patient being a middle-aged widow, who on September 18th was attacked with watery diarrhœa, vomiting, and cramps. Beyond these symptoms

none that were indicative of true cholera seem to have been observed, but the patient died suddenly on the morning of the 20th. On her burial, special precautions, such as are commonly observed in cases of cholera, were adopted. A third attack came under notice on September 22nd, the patient being a boy aged 13 years, residing in another part of the town. The boy had some trivial ailment on the 20th, but it was only on the 21st that diarrhœa set in, and he died the following day. Two circumstances are referred to by Dr. Copeman in connexion with this case. The first relates to the boy's habit of bathing in the river at a point where the water is fouled by sewage from a hospital and from certain dwellings. The second has to do with the sale, in Yarmouth, of cockles professedly coming from Lynn, but being in fact derived from Cleethorpes, and sent through Lynn in order to hide their place of origin. Close to the boy's home was a shell-fish shop which he is known to have frequented, but no evidence of his having actually purchased or eaten cockles was forthcoming. Bacteriological examination was made of a portion of this boy's ileum, which was transmitted for the purpose from Yarmouth to Dr. Klein (*see* Appendix B., page 182); and although no clinical history beyond that of diarrhœa, involving "suspicious-looking stools" and subsequent death, had been forthcoming, yet both microscopically and culturally the case was characteristic of cholera. Cultivations, indeed, in a number of media all revealed "pure crops of Koch's comma-bacillus."

The fourth attack commenced on the morning of September 28th, the patient being a girl nine years of age, residing with her parents and three other children in the Yarmouth "Rows." Vomiting, fluid evacuations of rice-water character, sub-normal temperature, sunken eyes, blueness of hands and lips, and corresponding collapse, were the early symptoms; from these she rallied in hospital, but death ensued within about eight days of the commencement of her illness. A rice-water stool, passed on the first day of attack, was found to consist of a colourless fluid in which were suspended flakes made up of epithelium; on bacteriological examination this stool was ascertained to be "a pure cultivation of Koch's cholera commas"; and the case was in other respects very typical of Asiatic cholera (*see* Appendix B., page 183). This attack was, like the others in Yarmouth, the only one which occurred in the house in question, and no definite history as to its cause could be made out. Close by was a shell-fish shop where children were supplied with cockles, and these cockles, like those previously referred to, came professedly from King's Lynn.

(*k.*) Ilkeston (Derbyshire).

At Ilkeston, in Derbyshire, there occurred about the middle of September four acute attacks of diarrhœal illness in adults which, taken together, were of a distinctly suspicious character. Three out of the four attacks terminated fatally, two of them within twelve and eighteen hours of their onset. The first

attack, in point of date, occurred in an adult male just convalescent from enteric fever; the symptoms were not those of enteric fever relapse, and death only occurred after eight days. Within six and nine days respectively of this man's initial symptoms, two of his sisters sickened. One lived with him, the other came daily to his house. Both had symptoms which resembled cholera; in one of them they were in several respects typical, and the patient died within twelve hours of her attack. In this case, microscopic and cultivation experiments with material derived from a portion of the ileum gave positive indications of cholera. Another case occurred in the person of a nightsoil scavenger. His attack took place about midway, in point of date, between the others; clinically it had much resemblance to cholera, and it rapidly terminated in death. This man's attack was not ascertained to be causally related to the others. There were faulty sanitary circumstances in connexion with each of the houses where these persons lived, but neither these nor any other circumstances, beyond the possibility of personal infection in the case of the two sisters, could be found by Dr. Wheaton, who visited Ilkeston, to account for the occurrences reported on. (*See* Appendix A., No. 12.)

(*l.*) Fulham (London).

On September 11th, an adult female, who was an inmate of the Fulham Workhouse, died after 20 hours' illness. Her death was certified to be due to "choleraic diarrhœa," but in notifying it the medical officer of the institution stated that he regarded the case as extremely suspicious in character. The patient rose as usually on the morning of the 10th, she had an attack of vomiting at 8.30 a.m., and a second attack soon after mid-day. Within little more than an hour of noon it was found that she had been seized with profuse vomiting and purging, which left her in an apparently insensible condition. Later on she became cold and blue, the temperature of the body was below 95° Fahr.; the purging and vomiting recurred, cramps set in, and after further very profuse purging, between midnight and 2 a.m. on the 11th, she died at 4.30 a.m. The bowel discharges in the later stage of the disease were reported to have resembled "water above, with soft white flakes below." The post-mortem appearances, which are described by Dr. Copeman (App. A., No. 13) and Dr. Klein (App. B., page 179) revealed, amongst other things, a deeply congested condition of the small intestine, which contained a fluid "like pea-soup," and a collapsed and empty urinary bladder. Microscopically, the intestinal contents exhibited numerous epithelial flakes crowded with bacteria, amongst which were a few comma-shaped organisms and numerous free flagella. Sub-cultures revealed pure crops of Koch's comma-bacillus, and in peptone culture the typical "cholera-red" reaction was well marked. The importance of this case lies in the following facts:—Clinically, pathologically, and culturally, the case was not to be distinguished from cholera of the Asiatic type: the patient had, for some two

years, not quitted the workhouse; she had not been known to have received any visitors from without; her food was that of the other inmates; all possible contact with infection, either direct or indirect, seemed to be excluded with a certainty that can rarely be attained; and the attack was apparently an isolated one.

(*m.*) North Bierley.

Between the close of the third week of September and the middle of the second week of October, there occurred in the Urban Sanitary District of North Bierley, in Yorkshire, a series of seven attacks of cholera. The attacks were generally of great severity, and in six out of the seven they terminated fatally. The first to be attacked was a youth who, after a stay at Southport, reached his home in North Bierley on the 18th of September. He was then suffering from diarrhœa. This diarrhœa would appear to have been maintained up to the 24th, when medical advice was sought. The youth was then found to be in a state of collapse, with cold extremities, sunken features, cramps, and sub-normal temperature; he was also vomiting and passing rice-water stools. At the end of three days there was some rally with febrile symptoms, but a condition of collapse returned and he died on October 3rd, the death being certified as due to "choleraic diarrhœa" with "collapse and exhaustion." The next to be attacked was this youth's mother, who was seized with typical symptoms of cholera at midday on September 26th. These symptoms included vomiting, diarrhœa, cramps, and sub-normal temperature. By 3 o'clock in the afternoon she had become profoundly collapsed, and she died at 11 p.m. on the same day. An adult sister of this woman took part in preparing her body for burial, and on the evening of the 28th she, too, was found to be in a state of collapse, and to be otherwise suffering from symptoms in every essential respect resembling those which had been followed by death in her sister. She died early in the morning of the next day, September 29th. The father of the youth was also attacked on the 28th; his symptoms being equally typical of cholera. After a slight rally, collapse again set in, and he died on October 1st. Another adult sister of the youth's mother had also taken a share in laying out the body of her relative. She was attacked with like symptoms on September 27th, and died on October 2nd. An aged woman, who was also related to this family, had not only visited the youth's mother in her illness, but had taken part in nursing the first of her two sisters during her illness on September 28th and 29th. She was taken ill with diarrhœa on October 1st; on October 5th the diarrhœa rapidly became worse, vomiting and cramps set in, typical collapse supervened, and she died on October 9th. All the above six patients had been attacked, and five of them had died by October 3rd. The attacks were, unfortunately, regarded as being cases of "choleraic diarrhœa" and "English cholera," and it was only subsequent to the occurrence of the five deaths

that the Board received, on October 5th, the first intimation of the outbreak. Dr. Bulstrode was immediately instructed to visit North Bierley, and a piece of the dead youth's ileum was procured for bacteriological investigation. But the material had already assumed a gangrenous aspect, and what is, perhaps, more important, it was only secured late in the illness, and after the stage of re-action had supervened. Hence it is not astonishing that, although the microscopical appearances were extremely suspicious of cholera, confirmation of this suspicion, as the result of culture experiments, was not forthcoming. When, however, the sixth patient was taken ill, she was visited by Dr. Bulstrode, and some of her discharges were collected and despatched to Dr. Klein, with the result that Koch's comma-bacillus was found in them on microscopic examination, this demonstration being subsequently confirmed by means of cultivation. The seventh patient in this series began to suffer from diarrhœa on October 1st, and when visited medically on the 4th, was found to have vomiting and diarrhœa. She alone of this group of seven cases subsequently recovered, having at no time exhibited typical cholera discharges or collapse. This patient, an elderly woman who was a friend of the family, had also taken part in laying out the body of the youth's mother.

This limited outbreak of illness (Appendix A., No. 14) affords a story that is typical of Asiatic cholera. If it differs from occurrences of cholera as heretofore observed in this country, it only does so by reason of its extreme severity and fatality. It is also somewhat singular in the fact that, unlike most attacks of similar suddenness or virulence, the infection was not due to a contaminated water supply. Direct infection by reason of contact with an antecedent case seems to have been more than commonly potent for mischief; for with the exception of one girl, whose movements could not be traced, all who took any part in nursing the sick or in preparing the dead for burial were attacked with the disease, and only one escaped death. From the etiological point of view there is but one link missing in the story. Nearly three weeks had elapsed between the date when diarrhœa was first recorded in the youth who suffered from the initial attack, and Dr. Bulstrode's arrival in North Bierley; the patient in question had since the onset of his earliest symptoms been resident in two different counties; and both he and all but one of his near relations, from whom trustworthy information might have been forthcoming, had since died. Under these circumstances it is not to be wondered at that no conclusion could be come to as to the source whence the infection had been derived. In this connexion it should also be remembered that one or more cases of reputed cholera had, at the date of the onset of diarrhœa in the youth concerned, already manifested themselves in 47 different sanitary districts of England, including 12 localities in the two counties referred to.

(*n.*) Tividale (Rowley Regis U.S.D.).

Between the morning of September 23rd and that of September 25th, five adults and a boy of six years of age were seized with grave symptoms at Tividale, a colliery hamlet in the Rowley Regis Urban District. (Appendix A., No. 15.) Five out of the six attacks occurred in contiguous yards of the same street; the yards presenting conditions favourable to the pollution of both air and soil, and in one instance the water of the well was open to suspicion. The sixth attack occurred in a row where nearly every sanitary circumstance apart from water supply was grossly defective. The symptoms from which this group of patients suffered included severe and sudden vomiting with purging, cramps, at times intense, shrivelling and blueness of the skin, sunken eyes, and vox cholerica. Such motions as came under medical observation were, in the main, not such as are strictly regarded as of the "rice-water" type. Two of the six patients died within 24 hours of being attacked, and bacteriological examination of a portion of the intestine in one of these cases, an adult woman who died on September 25th, revealed evidence such as is associated with definite cholera. Dr. Sweeting reached Tividale on the 26th, but before this date there had been such disposal of the dejecta of the patients as might in itself have served to spread infection. On the 27th two other attacks occurred, one of the patients being the child of the woman who had died on the 25th, and the other an adult female who had been constantly in and out of the cottage where this death had occurred. The original cause of this occurence in Tividale was not discovered; and although in some cases there was at first suggestion as to the attacks being possibly related to the consumption of such articles as mussels, nothing confirmatory as to this could be made out. The simultaneity of the first attacks would seem to point to some common but undiscovered cause; perhaps this had to do with certain antecedent cases of diarrhœa, which had taken place in the very neighbourhood where the majority of the earlier attacks occurred.

(*o.*) Coton Hill Asylum (Staffordshire).

A report by Dr. Bulstrode (Appendix A., No. 16) deals with two diarrhœal attacks which occurred in the Coton Hill Asylum, near Stafford, on September 26th and 29th, and which, though lacking some of the clinical characters of true cholera, both terminated fatally with symptoms of collapse within less than 18 hours of the onset of the disease. The two patients in question occupied the same ward, but they alone, out of 136 patients and of the asylum staff, suffered from any malady at all suspicious of cholera. Inquiry, both within and without the asylum, failed to associate the attacks with any previous case or with any food supplies. But, on the occurrence of the second death a portion of the ileum was submitted to bacteriological investigation, with the result that both microscopically and culturally evidences indicative of true cholera were obtained.

General Considerations.

From the reports embodied in Appendix A., some of which I have already particularised, it will be evident that after the importation of a few isolated cases of cholera into certain English ports in June and July 1893, definite cholera prevalences set in at Grimsby and Hull during the month of August, and that following on this event a number of attacks, mostly isolated ones, occurred in different parts of England during the period August to October. The beginnings of cholera in both of the Humber port towns are involved in obscurity. Cholera was on several occasions imported into both these ports in August and September 1892, and it is, of course, just possible that the disease may at that date have made its way into the towns abutting on these ports in an unrecognised form, and that in this way the occurrences of 1893 may have been due to recrudescence of the infection, first in mere diarrhœal form, and then, as the disease progressed further into the autumnal season, as unmistakeable cholera. This view might well be regarded as finding some support from the fact that, prior to the recognition of cholera in both of the towns in question, there had occurred an exceptional prevalence and fatality from diarrhœal disease. But, on the other hand, cholera epidemics, whether in this or other countries, have again and again been associated with similar occurrences of antecedent diarrhœa; and this when the recrudescence of a former local infection could not possibly have been in question. Indeed, the story of cholera in the Humber towns last year is typical of that which might have been expected if, during the early stages of a recrudescence of the disease on the continent of Europe, cholera had been imported anew into this country. It was because of the well-known chances of importation in this obscure form that the Cholera Survey of our ports and towns was instituted, and it must be admitted that, in Grimsby at least, that which actually took place is precisely what might reasonably have been anticipated. Indeed, I can feel but little doubt that not later than mid-July cholera from abroad made its way anew into Grimsby, and thence into the neighbouring town of Cleethorpes, and that the "diarrhœa," which alone was at first apparent, soon assumed a type so significant, in point of fatality and otherwise, as to have called for the adoption of exceptional measures of prevention at a much earlier period than that at which these were actually practised. The returns as to the earlier attacks of diarrhœal disease in the third quarter of 1893 are too incomplete to enable me to say in what relation the diarrhœal outbreak in Hull stood, in point of time, to that in Grimsby, but it is certain that whereas disease which was classed as "choleraic diarrhœa" or "cholera nostras" was ominously fatal in Grimsby from the beginning of August, no deaths were attributed to like causes in Hull until late in the month. It does not follow from this that Hull necessarily received its cholera, in 1893, from Grimsby, for

both ports were at the time in relation with infected districts on the continent of Europe; but such a sequence of events is not improbable in view, not only of the communication existing between the two port towns, but also of the subsequent relation of the cholera prevalence in Grimsby and Cleethorpes to cholera in other parts of England.

These two latter towns, which for present purposes may be regarded as one, are visited every summer by enormous numbers of the artisan class, especially from South Yorkshire, South Lancashire, and the North Midland Counties. In the six months May–October, 1893, no less than 235,721 excursionists were booked to these towns by the Manchester, Sheffield, and Lincolnshire Railway, and this notwithstanding the fact that during two months of that period it was well known to the public that cholera was prevalent in both places. A large proportion of the excursionists stay only a single day in the locality, and with many others the stay is one of very short duration. They come to the Humber sea-side resort for a few hours, and then, as it were, radiate out from it, as a centre, as they return to their homes. In a number of instances it is known that cholera was first recognised in certain parts of England either as occurring in persons who had arrived from Grimsby and Cleethorpes, or in the immediate relatives and friends of such persons, and that the outbreak of the disease was so related to the date of the sea-side visit as to make it probable that the one had concern with the other. And when the maps are examined with which Dr. Barry's report is illustrated, and which show the topographical distribution of cholera in England during 1893, it will be seen that, apart from importations into ports, 34 out of the 50* places in which choleraic outbreaks occurred in England, lie within an angle having its apex at the mouth of the Humber, and of which one side passes southwards through Leicester, and the other northwards through York. Indeed, outside this angle, which includes the area from which the excursionists referred to were mainly derived, there only occurred 39 out of the total of 287 cases of cholera and reputed cholera which were recorded in England last year. Even these 39 are not necessarily to be regarded as being cases that had no concern with the Humber sea-side resort—in some, indeed, such relation was, to say the least, suspected — and it will be obvious that the scattering of nearly a quarter of a million of people, who had spent some time in a cholera-infected locality, afforded exceptional opportunities for a like scattering of the cholera poison over a wide area of England, and this under circumstances that would make it well-nigh impossible in many cases to follow out the channels by which infection may have been conveyed. Happily, the tripper's stay in Grimsby and Cleethorpes was commonly one of hours rather than of days, otherwise the resulting mischief would probably have been on a

* The Metropolis is here regarded as a unit.

wider scale: and, happily for England, in neither town did the specific infection get access to a public water service.

SHELL-FISH AND THE SPREAD OF CHOLERA.

There is another matter which deserves consideration in connexion with the influence of Grimsby and Cleethorpes on this prevalence of cholera. In a number of cholera attacks the antecedent history of the sick involved either the consumption, or the reception at their homes, of oysters or other shell fish which had been procured at or derived from Cleethorpes and Grimsby; and under these circumstances Dr. Reece was instructed to include in his Report (Appendix A., pages 86–88) some account of the trade in oysters, mussels, and cockles, as carried out in these places. This account shows not only that the oyster beds at Cleethorpes are almost necessarily bathed each tide with the effluent from the Grimsby and Cleethorpes sewers, but that oysters are so stored inside the Grimsby docks as once again to expose them to contamination by sewage. The mussel trade is worked under nearly identical conditions, but the mussels are more exposed to sewage than even the oysters. The cockles are mostly used for consumption in the district, but one large bed of them is stated to be "exceptionally exposed to the influence "of Grimsby and Cleethorpes sewage." Some of these shell fish are not often eaten raw; others again, notably oysters, are largely consumed without cooking, and when so eaten the removal from the shell of the liquid in which the oysters lie is a thing that is generally somewhat carefully avoided. The state and sources of the "waters" in which the oysters are grown or kept come, therefore, to acquire importance in so far as the public are concerned; and having regard to the significant indications afforded by some of the cholera histories of last year, I cannot avoid the conviction that shell fish from Cleethorpes and Grimsby must, in some cases, remain under suspicion as having contributed to the diffusion of the disease.

In opposition to this view it has been alleged that, having regard to the enormous operations of the Cleethorpes oyster trade, the effects, if any, could hardly have been so limited as appears to have been the case last autumn. But this argument has not much weight when it is remembered that, with regard to oysters, for example, as a channel for conveying the infection of cholera, it would be necessary that the shell or body of the mollusc should retain some portion of the sewage, which on this coast is stated to be enormously diluted with sea water; that such sewage should happen to comprise some of the cholera infection which last autumn was passing from the sewer outfalls; and, further, that this poison should be received by some susceptible person without prior destruction by a process of cooking. The concurrence of conditions such as these in regard of persons not otherwise exposed to cholera infection, is by no means likely to have been habitual; and it is the conviction that their co-existence must have been comparatively rare that prevents me from speaking in more positive terms as to the

precise relation of the shell-fish trade in these Humber towns to cholera in England in 1893.

But one thing is certain. Oysters and shell fish, both at the mouth of the Humber and at other points along the English coast line, are at times so grown and stored that they must of necessity be periodically bathed in sewage more or less dilute; oysters have more than once appeared to serve as the medium for communicating disease, such as enteric fever, to man; and so long as conditions exist, such as those with which the oyster trade of Cleethorpes and Grimsby is shown to be associated, conditions which may at any time involve risk of the fouling of such shell fish with the excreta of persons suffering from diseases of the type of cholera and enteric fever, so long will it be impossible to assert that their use as an article of diet is not concerned in the production of diseases of the class in question.

Central Administrative Action.

At the beginning of the year 1893, the Medical Department had been strengthened by the addition to its staff of two permanent and four temporary Inspectors, and thus re-inforced much was done for the prevention of cholera that would otherwise have been difficult if not impossible of achievement. Whilst I shall reserve an account of the action taken under the general Cholera Survey of our port and inland sanitary districts for my report on the proceedings of the Department during the official year 1893–94, I propose to refer at once to the more special action that was taken by the Medical Department, as attacks of cholera or of reputed cholera came within the cognizance of the Board.

The Board having announced beforehand that they were prepared to institute such bacteriological researches as would assist sanitary authorities in differentiating, as regards first cases of choleraic disease, between true cholera and diarrhœal disease having certain like features, a very large number of attacks of disease, more or less resembling cholera, came within the knowledge of the Medical Department at an early stage of their occurrence. The information transmitted was often accompanied by material derived from the sick, and was followed by some clinical history of the cases in question. Such advice as could be given promptly, either on the clinical aspects of the case, or as the result of preliminary microscopic investigation of material received, was at once despatched by telegraph; and this, as will be hereafter related, was followed by further action as the later circumstances and investigations indicated. The work of the Medical Inspectors was so contrived that a certain number of them were always available for immediate service in connexion with such occurrences, and in a considerable number of cases they acted on instant instructions and at once left for the localities which were in question,

with a view of eliciting more detailed information, of assisting, where necessary, in the diagnosis of the disease which had occurred, and of advising as to the more immediate measures of prevention that were necessary. In some instances these visits were renewed more than once; and in certain localities the measures of sanitary control were throughout under the supervision of the Board's Inspectors. By means such as these the Board were kept in immediate touch with much that might otherwise have escaped their notice until after production of the very results which it was their object to avoid. On the other hand, the record which I append to this Report shows that there were instances in which, owing to the difficulty experienced in apprehending the precise nature of one or more early attacks, communication with the Board was delayed, and there was extension of cholera, with corresponding loss of life. But, reviewing these administrative measures as a whole, I have no hesitation in saying that they materially contributed to the control of cholera in this country, and I may, perhaps, be permitted, under the exceptional circumstances of this special report, to place on record my high appreciation of the services which were rendered, during the autumn of 1893, by the staff of Medical Inspectors acting under my direction. Emergency work of the class referred to was for some time all but incessant, and the Inspectors were often engaged in their duties both by night and by day; but on no occasion were the claims of duty subordinated to considerations of personal comfort or even of health.

In the case of Grimsby and Cleethorpes only was it necessary to proceed beyond such action as I have described. Cholera was already established in both these places when it first came within the Board's cognizance, and it was hence deemed requisite at once to issue the epidemic regulations to which I have referred, and to declare them in force within both of the urban areas and in the Port Sanitary District concerned.

Bacteriological Investigations.

The discovery by Koch in 1883, during the cholera epidemic in Egypt, of his comma-bacillus gave a new impetus to the study of the intimate pathology of disease exhibiting the symptoms of cholera. In the course of the next few years, cholera being meanwhile prevalent in certain countries bordering the Mediterranean, a number of different observers made independent announcement that in true (Asiatic) cholera *alone* is the vibrio in question found inhabiting the intestine of the human subject. Antecedent therefore to the most recent extension of cholera to Europe, the presence of Koch's commas in the dejecta of a person suffering choleraic attack had become generally accepted by etiologists as identifying such illness with true cholera. Further, bacteriologists—whether they belonged to that larger section of observers accepting Koch's comma as the

vera causa of cholera, or were among the few who inclined to regard this vibrio as rather a consequence than the cause of that malady—had also become agreed as to the importance, for diagnostic purposes, of detecting in the dejecta of persons suffering attacks of cholera-like nature the presence of Koch's comma-bacillus. But, in 1892, when cholera again invaded Europe, differentiation of Koch's vibrio from other microbes that can inhabit the human intestine was neither easily nor quickly attainable. Morphologically this vibrio could not with certainty be distinguished from other and similarly shaped bacteria. Only by its behaviour on artificial culture in solid media—as for instance gelatine—could it be satisfactorily differentiated from other vibrios. And, as is well known, on artificial culture in media of this class the characteristic features of Koch's vibrio are not manifested until after lapse of a considerable interval of time. The desideratum therefore in 1892 was—some means whereby this vibrio that is held to be associated with true cholera, but with no other disease, could not only be easily identified in the dejecta of persons attacked, but identified with a promptitude allowing of proper precautions being at once taken in regard of each cholera case as soon as it arose.

Accordingly in 1892 bacteriologists generally, and particularly those of the German nation, to whom the cholera outbreak at Hamburg in August of that year afforded exceptional facilities for such study, set themselves to discover means of promptly identifying in the bowel contents of cholera cases the vibrio in question. And in this direction a considerable amount of success was ere long obtained.

It was matter of general observation in the course of the 1892 epidemic in Western Europe that not only was Koch's vibrio present in the bowel contents of sufferers, often to the almost complete exclusion of other micro-organisms, but that it tended to distribute itself in very definite arrangement in the débris of their intestinal mucous membrane. Thus, in the shreds of epithelium which abounded in the rice-water dejecta of the Hamburg cases, numerous comma-bacilli could, in microscopic specimens from nearly one-half of the cases examined, be seen arranged in very peculiar grouping. The vibrios in such microscopic specimens were observed to lie with their long axes in the same direction; so that a group of them resembled a shoal of fish in the act of stemming a slowly flowing stream. In no other disease except cholera, Professor Koch affirmed, is this appearance witnessed; and thus he came to regard such grouping of commas in the intestinal flakes as absolutely diagnostic of true cholera. As to cases, indeed, responding in this way to microscopic test, Dr. Koch further insists that entirely trustworthy evidence of their being true cholera can be obtained within a few minutes only of submission of material from them to the procedures of the skilled bacteriologist; for, as he points out, the positive evidence thus obtained in Hamburg cases had never been called in question on

subsequent testing of the same material by the older and more deliberate method of culture on artificial solid media.

But though, in this way, nearly half the cases occurring in Hamburg could be immediately identified as true cholera, it was also found that in the larger proportion of attacks microscopic testing, in the above sense, of the raw material gave equivocal or negative results. Either the cholera vibrios in the epithelial flakes or fluid contents of the bowel were outnumbered by other microbes, and failed, therefore, to present under the microscope the arrangement characteristic of cholera; or, they were not to be detected at all by this comparatively rough-and-ready process. For failure, however, in this sense, a remedy was found. It was ascertained that in Dunham's peptone solution a means was at hand for sorting out Koch's commas from among a multitude of similar and dissimilar microbes. In this fluid medium—which consists of one per cent. peptone and half per cent. sodium chloride—the vibrio in question gets the start, so to speak, for the time being, of all micro-organisms with which it is associated, multiplies itself exceedingly, and in its eagerness for oxygen colonises the surface of the peptone solution to the exclusion of the other microbes; so that in the upper portion of this medium, when rendered turbid by its life processes after incubation for half a dozen hours at 37° C., Koch's vibrio is found practically in pure culture—as may be verified by microscopic examination of droplets of the medium as cover-glass specimens. Furthermore, this vibrio has, it was found, the faculty of evolving in this same peptone solution—and with a rapidity parallel to its own multiplication there—indol and nitrites, the presence of which is, on the addition of a drop or two of pure sulphuric acid, at once revealed by development in the peptone tube of a rose-blush colour—the so called "cholera-red" reaction.

When therefore, in 1893, cholera having become recrudescent in Western Europe, cases of the malady, imported or indigenous, were reputed to be making their appearance in this country, means were seemingly at hand for determining—in something like half the cases in a few minutes, in the remainder within 24 hours—whether, from the bacteriological view-point, any suspected attack was one to be dealt with as true cholera. In these circumstances, and to the end that Sanitary Authorities should not be hampered in their administrative measures by uncertainty as to the nature of the cholera-like disease appearing in their districts, the Board undertook the duty of ascertaining through Dr. Klein, as regards *first* cases of reputed cholera, whether or not the dejecta of the patient contained Koch's comma bacillus. Accordingly, Sanitary Authorities giving timely notice—along with certain necessary particulars—to the Board of the occurrence in their districts of attacks suspected to be cholera, were invited to forward to the Medical Department material (dejecta or actual bowel, according as the attack was non-fatal or fatal) from such cases with a view to its submission to Dr. Klein

for bacteriological examination and report. And meanwhile the necessary arrangements were made for transmission with the least possible delay to each Sanitary Authority, thus seeking the Board's assistance, the facts ascertained by Dr. Klein in the particular instance. As a result of this action by the Board, material from 53 reputed cases of cholera in various parts of the country was examined and reported on by Dr. Klein, and, as will have appeared in the comments I have made as regards one and another sanitary district, the operations in the repression of cholera carried out by many local authorities were hereby materially assisted.

Dr. Klein's detailed account of his procedures and their results (Appendix B.), studied in connexion with the facts elsewhere recorded in this volume respecting the clinical histories and antecedents of the cases he deals with, will prove of not less interest to the etiologist than to the pathologist. In the main, he followed in his investigation of the materials submitted to him the lines that have already been referred to as advocated by Professor Koch. Thus:—

As matter of first instance, Dr. Klein took note of the physical condition of each sample of material (dejecta, or bowel and bowel contents), and then at once proceeded to microscopic examination of these matters by means of cover-glass specimens. Whether or not indication was thus obtained of the presence in the material of Koch's comma-bacillus, cultures were at the same time instituted in peptone salt solution, samples of which, after incubation for six hours, were in turn examined at short intervals by the cover-glass method, and finally, after 12 to 16 hours' incubation, this medium itself was tested for cholera-red reaction. And always, even though the peptone test gave positive results, sub-cultures from the peptone medium were for additional security established in the orthodox solid media—gelatine and agar.

In a minority of the cases examined, cover-glass specimens of the epithelial flakes from the intestine revealed comma-bacilli unmixed with other organisms, and arranged in the manner regarded by Koch as belonging only to cholera. With reference to cases of this sort the Sanitary Authority concerned was at once informed that the attack was, in all probability, true cholera; and later, when the diagnosis thus provisionally arrived at by Dr. Klein had been confirmed by the results of culture by him of the material in peptone salt solution, the Authority was duly apprised of the fact of such confirmation.

But more commonly microscopic examination of the raw material from the intestine, though perhaps giving rise to suspicion, afforded no sufficient indication of the presence therein of Koch's vibrio. In these cases Dr. Klein's diagnosis was not pronounced until culture of the material in peptone salt solution had supplied evidence positive or negative as to the presence of Koch's commas. Information to the Sanitary Authority as to the

bacteriological dictum respecting cases of this description was consequently delayed some 12 to 16 hours.

In yet another class of case, direct culture of the raw material in peptone salt solution proved equivocal or negative, and, indeed, cases were met with wherein this result followed, though examination of the raw material by the cover-glass method had seemed to give what were regarded, bacteriologically, as "positive" results. As regards doubtful material of this sort, sub-cultures were set going in secondary (or even in tertiary) peptone tubes, and from these in turn solid media were inoculated and duly incubated at proper temperatures before a judgment was arrived at for or against the presence in the material of Koch's cholera vibrio. Meanwhile the Sanitary Authority concerned was duly informed of such suspicions as so far were indicated. Subsidiary testings in this fashion of necessity involved considerable expenditure of time, and hence in particular instances a final bacteriological decision as to the nature of the case was not forthcoming until after the lapse of two or more days.

Passing next to details of the results obtained by Dr. Klein, the 53 reputed cholera attacks reported on by him may be resolved into three groups or series, thus:—

Series (*a.*).—Fifteen cases in regard of which microscopic examination of the stools or bowel contents sufficed to indicate the presence of epithelial flakes containing comma-bacilli, not only in pure culture but distributed also in the fish-like arrangement which Koch considers absolutely characteristic of true cholera. In each of these 15 cases the above result was obtained within a few minutes of receipt by Dr. Klein of the raw material, but, as has been already intimated, in no instance was a definite diagnosis of true cholera pronounced by him until the presence of Koch's comma-bacilli in the material had been also demonstrated as the result of the peptone culture test.

Series (*b.*).—Other fifteen cases wherein microscopic examination of the stools or bowel contents gave equivocal or negative results, but in regard of which the application subsequently of cultural tests proved the presence in the material of Koch's cholera vibrio. All these 15 cases, like the 15 in series (*a*), were accordingly pronounced, from the bacteriological view-point, to be true cholera. And,—

Series (*c.*)—Twenty-three cases as to which the presence of Koch's vibrio in the material submitted to him could not be demonstrated by any of the means at Dr. Klein's disposal.

So that of the total 53 cases dealt with by Dr. Klein, as many as thirty (56·6 per cent.*) were found, bacteriologically, to be true cholera, while in twenty-three (43·4 per cent.) the evidence was, from Dr. Klein's point of view, negative in character.

These bacteriological dicta by Dr. Klein were necessarily independent of the clinical histories and the antecedents of the

* See Dr. Klein's table of facts respecting his 30 "positive" cases, pages 190–91.

cases upon which he was reporting. For the most part he knew nothing of these matters, and even in regard of particular cases as to which he did receive some information, the facts in nearly every instance came to hand *after* his bacteriological dictum had been pronounced. In these circumstances, the clinical features and the antecedent histories recorded elsewhere in this volume, of the 30 and of the 23 cases respectively, become of the greater interest and importance. The facts in this connexion are briefly as follows :—

First.—As to Dr. Klein's 30 *positive* cases—included in series (*a.*) and (*b.*)—in regard of which a bacteriological verdict of the cholera was arrived at. Almost without exception they were found to have presented symptoms indistinguishable from those of Asiatic cholera. All but two proved fatal, generally within 24 hours of attack, and those of them which recovered or in which a fatal termination was delayed beyond 24 hours, were for the most part among the cases in which the clinical symptoms had been least equivocal in their suggestion of true cholera. In short, judged in their clinical aspects, they came nearly every one of them under grave suspicion of true cholera, and from this view-point, therefore, the positive evidence to the same effect afforded by Dr. Klein's investigations of their stools or bowel contents might seem to a corresponding extent superfluous. When, however, regard is had to their antecedent histories, the dictum of bacteriology that they were all of them true cholera is seen to be not without important and practical bearing. Only in a minority of instances had the persons whose attacks are in question been residing in localities where unmistakeable cholera had already manifested itself, or in which definite cholera not long afterwards made its appearance More than half the 30 cases occurred under circumstances which, but for bacteriological testimony as to the real nature in each instance of the malady, would have tended to discount the clinical features of the attacks in the direction of suggesting to the authorities, medical or other, concerned, that the attacks in question were examples merely of "English" cholera, and not, therefore, calling for measures of precaution such as are admittedly necessary when the Asiatic variety of cholera is detected in a given locality. There can be little question, indeed, that in regard of a considerable proportion of these 30 cases the action taken by the Board in putting them to the bacteriological test encouraged the local Sanitary Authorities to preventive measures that might otherwise have been carried out in less thorough fashion than in the actual circumstances was shown to be desirable, or even delayed until extension of cholera in the locality had demonstrated urgent need for them. The *positive* evidence, therefore, that was obtained, through the Board, from bacteriology respecting the nature of cholera-like attacks, has been distinctly of advantage to local sanitary administration.

Secondly, with reference to Dr. Klein's 23 *negative* cases, *i.e.*, those in regard of which he failed to find, by any of the methods at his disposal, evidence of the presence of Koch's cholera vibrio. Here the testimony of bacteriology would appear less satisfactory. It is true that these 23 cases comprised half-a-dozen attacks, as to which the material submitted to Dr. Klein had been previously exposed to germicidal influences, or was forwarded at so late a stage of the person's malady as to be practically useless for his purposes; that hardly more than half of the 23 proved fatal; that in such as were fatal, death was often much delayed; and that the antecedent conditions under which the 23 had lived were rarely such as to class them with cholera. Nevertheless, they included not a few attacks that clinically could not be distinguished from true cholera; some of them, indeed, with antecedents tending to presumption that the cases were of the Asiatic variety.

This last-mentioned experience, namely, the absence of bacteriological proof of true cholera in cases which clinically and otherwise directly indicated that disease; as also, bacteriological affirmation of true cholera in cases which did not clinically or by reason of their antecedents seem to justify such diagnosis; determined the Board to direct in 1894 more extended investigation of the comparative bacteriology of "English" and Asiatic cholera.

Several points of interest, arising from Dr. Klein's observation of reputed cholera material, remain to be dealt with. Dr. Klein, fully accepting the view that identification of Koch's vibrio in the dejecta (or bowel contents) of a person suffering choleraic attack suffices for diagnosis of true cholera, notes, in regard of his further experience in 1893, certain easily ascertained indicia as to its presence, to be obtained by microscopic examination of raw material from reputed cholera cases; and he discusses at length the behaviour of this vibrio in his hands on culture in a variety of artificial media.

As to indicia referred to, Dr. Klein found that in every one of the cases in which this organism was demonstrated by subsequent culture in peptone salt solution or other media, epithelial flakes were more or less numerous in the stool or bowel contents. But, on the other hand, several cases came under his notice in which, though he discovered epithelial flakes in the raw material sent him, his subsequent culture of the samples in the usual media failed to reveal the presence of Koch's vibrio. The presence, therefore, of epithelial flakes in the rice-water stool would appear, judged bacteriologically, a less certain indication of true cholera than had been thought by some observers. Given, too, the presence in the raw material of epithelial flakes, in a minority of cases only did Dr. Klein find Koch's vibrio in pure culture in such flakes and arranged therein in the manner regarded by Koch as characteristic of true cholera. More frequently in Dr. Klein's experience comma-shaped

organisms were with difficulty discovered in the flakes, and sometimes were not to be found there at all, even in cases in which their presence was subsequently demonstrated by appropriate cultural tests. However, as regards the great majority of the cases subsequently proved culturally to be true cholera, Dr. Klein found in the raw material an indicium that he is disposed to regard as of great importance in making provisional diagnosis. This was the presence in the epithelial flakes, or in the fluid containing them, of free flagella that had become dissevered from the vibrios to which they belonged. But this again proved no certain criterion, for in certain of the cases in which flagella-like bodies were numerous in the raw material, Dr. Klein was unable to detect Koch's vibrio by cultural experiment.

With reference to his cultural observations of the vibrios obtained by him in 1893, from the reputed cases of cholera, Dr. Klein is fully confirmed in a suspicion previously entertained by him, namely, that comma-bacilli from different cases of true cholera exhibit biologically, in the laboratory, marked and stable differences *inter se*. For instance, the cholera comma as obtained by him from a particular case failed to liquefy gelatine when grown therein in stab-culture, although in all respects it responded to the tests for Koch's vibrio; and in several other instances comma-bacilli from different cholera cases were able sooner or later to curdle milk, a function not possessed, as Koch himself points out, by Koch's vibrio. In their behaviour, too, in other culture media, certain of the comma-bacilli isolated by Dr. Klein differed in minor ways from that noted by Koch in regard of his cholera vibrio. And as a result Dr. Klein has come to consider the comma-bacilli obtained by him in 1893 from cholera cases in this country as representing at least several varieties of cholera vibrio. He is, indeed, disposed to suspect that under the term "Koch's Vibrio," there may be included more than one distinct species of microbe.

Diarrhœal Outbreak at Greenwich Workhouse.

Diarrhœal Outbreak at Greenwich Workhouse.

In connexion with these investigations as regards cholera in England during the year 1893, much interest attaches to the occurrence of a diarrhœal outbreak which prevailed in the Greenwich Union Workhouse, and which is reported on at length by Dr. Bulstrode (*see* Appendix C.). The first attack which came to the knowledge of the medical officer of the institution commenced on October 4th, but between that date and October 24th, 240 inmates and 5 nurses had been attacked, besides which 4 cases were imported from without. Eleven of the cases terminated fatally, all the deaths occurring in persons attacked between October 8th and 12th. The more obvious clinical characters of the disease were as follows:—The patients commonly awoke early in the morning with severe abdominal pain, followed by diarrhœa, vomiting, and cramps; the

features became contracted, the lips and extremities were blue and cold; the voice was feeble, there was intense thirst, and generally extreme collapse. Often, too, the patients had suffered for a few days from premonitory diarrhœa. The motions and vomit were watery and inoffensive, but in no case were any typical rice-water discharges seen. There was a distinct tendency to relapse. The incidence of the disease was all but wholly on those who had passed the age of childhood, and still more especially on those over 60 years of age. The 11 fatal attacks were all in persons over 60 years. The post-mortem appearances included marked injection of the small intestine, more especially towards the ileal extremity, and an empty or contracted urinary bladder.

The outbreak having thus certain resemblances to cholera, and cases of this disease being known to prevail in certain provincial parts of England at the time, it was deemed advisable, amongst other methods of inquiry, to resort to bacteriological study; and in 12 cases material was available for such purpose. This material included stools, as well as portions of the ileum and of other organs. Dr. Klein's account of these will be found in an addendum to Dr. Bulstrode's report. In three instances distinct comma-shaped bacilli were found, but in none of these did the organisms respond to the cultural or chemical tests which are held to indicate Koch's bacilli; in one instance they were found in every respect to resemble Finkler's commas. In this latter case, flagella were attached to the comma-shaped organisms derived from a portion of ileum; and in another of the three cases free flagella were seen. In two cases micro-organisms were found which in some respects resembled comma-shaped bacilli, but cultivations from the material were altogether negative as to the recognised cholera organism. In the remaining six instances the results were negative as to existence of comma-bacilli, both microscopically and as the result of culture experiments. In one of these latter instances there were crowds of an organism which was apparently the bacillus coli. In no instance, says Dr. Klein, could the cholera bacillus be isolated by peptone culture; and in view of this and of certain other considerations he came to regard it as in a high degree improbable that the attacks in question were of the nature of true cholera.

But whilst the bacteriological investigations were thus negative as to true cholera, a definite bacillus was found in a number of the samples of material examined. This bacillus had certain marked resemblances both to the influenza bacillus and to the common putrefactive microbe, proteus vulgaris; but it also presented certain points of difference to both. For the moment, it would appear to be a distinct micro-organism belonging to the same group as the proteus vulgaris; and there is no indication of its having had any causal relation to the outbreak.

In the meantime, exhaustive inquiry as to the cause of this outbreak was proceeding in other directions, and certain

structural and administrative arrangements of the several buildings comprised in the institution tended to facilitate the exclusion of one or other condition as a cause of the disease. Thus the buildings included both a workhouse and an infirmary. The inmates of the workhouse at the date of the outbreak were 1,179 in number, and of these no less than 238 were attacked; the infirmary contained 380 inmates and 40 nurses, and of these only two inmates and one nurse were attacked, and this although there were certain inter-relations between the two establishments. The drainage of the workhouse is in large part distinct from that of the infirmary, and that belonging to the workhouse presented obvious defects. But one wing of the workhouse has its drainage in common with the infirmary, and it was in this wing that the earliest manifestation of the outbreak occurred. For this and other reasons conditions of drainage offered no satisfactory explanation of the occurrence. Water came early under suspicion, for whilst the workhouse water was derived from a well which gave indications of being subject to the risk of pollution, no similar suspicion attached to the supply derived from a separate deep well at the infirmary. On further investigation the workhouse water was pronounced to be chemically bad, and when microscopically examined it was found to contain not only the bacillus coli, which is commonly derived from the human large intestine, but amongst other micro-organisms, one which morphologically did not differ from the cholera vibrio. But when further studied by cultural tests, this comma-shaped organism failed to respond to the tests which are regarded as indicative of the true cholera vibrio. This well water must be regarded as having in all probability been subject to pollution by reason of leakage from a defective drain or drains in its vicinity; and its relation to the outbreak in the workhouse would have appeared a reasonable solution of the diarrhœal outbreak, were it not that amongst somewhat over 70 children under 16 years of age, and who were supplied with this well water, there only occurred one attack which resembled the malady prevailing amongst the adult inmates. There were, however, several smart attacks of diarrhœa amongst infants in the general wards during the period in question.

No question of food supply was found to account for the epidemic malady. Not only were the articles of diet in the workhouse and in the infirmary practically identical, but the character of the diarrhœa differed from that which is known to be due to so-called "food poisoning."

One thing seems clear, namely, that the diarrhœal disease had some infective quality. This is shown by its exceptional incidence on the workhouse staff of whom 16 per cent., and on the nursing staff of whom 33·3 per cent. were attacked; and the excess of its incidence on female inmates as opposed to males appeared capable of being explained in the same way.

During the course of Dr. Bulstrode's inquiry it transpired that, antecedently to any recognised attacks in Greenwich

Workhouse, there had been in certain parts of Greenwich beyond the precincts of the workhouse, an occurrence which, though limited in point of numbers, was clinically the counterpart of that which took place within its precincts. This prevalence in Greenwich commenced towards the close of September; and, as in the workhouse, persons coming into immediate contact with the sick contracted the disease. Three medical practitioners suffered in this way.

It would thus appear that in Greenwich town, and subsequently in Greenwich Workhouse, there occurred in the months of September and October 1893, an outbreak of acute diarrhœal disease, which in many of its clinical aspects was not unlike that form of diarrhœa with which outbreaks of definite cholera have so commonly been associated; that, pathologically, the disease presented certain features resembling those met with in cholera, whilst it lacked others deemed characteristic of the Asiatic disease; and that bacteriologically, whilst there were some microscopic indications in a few cases that were at first suggestive of true cholera, the material examined in the majority of the cases lacked these indications, and in no case was a first suspicion of cholera confirmed as the result of cultivation experiments. There is also strong suspicion that the disease was introduced into the workhouse from without. Facilities for such introduction undoubtedly existed; indeed the attack which first brought the outbreak under notice took place in the person of an inmate who was spending the day away from the institution. There is also every reason to suppose that mild attacks, whether contracted within or outside the workhouse, could easily have escaped notice before medical recognition of the prevailing malady. If the disease was imported it soon found opportunity for spread; although it is difficult to account for the rapidity and extent of its diffusion by means of infection conveyed from person to person. How far some circumstances connected with the workhouse well water, which were undiscoverable at the time that inquiry was undertaken and when the disease was on the wane, could have operated to produce the mischief within the limits of its special incidence on different buildings and on different sets of inmates remains undetermined.

I have the honour to be,
Sir,
Your obedient Servant,
R. THORNE THORNE.

December 1894.

No. 1.

Report on Cholera in England and Wales in 1893; by Dr. F. W. Barry.

During 1893, as in 1892, cholera was from time to time imported from abroad to one and another port of England and Wales. But in an important respect the behaviour of cholera in 1893 in this country differed from that observed in 1892. The disease made its appearance, though to a limited extent among the resident population of particular localities.

In the following report I have the honour to submit a detailed account of (*a*) cholera detected on vessels arriving in England and Wales "from foreign" during 1893, and (*b*) reputed cholera among English communities during the same year.

In each instance the facts are dealt with chronologically. As regards ship-borne cholera, the ports implicated are taken according to the date of arrival of infected vessels, or to the date of development (after arrival) of cholera on shipboard. And as regards cholera among our own population, the several localities in which the disease made its appearance are dealt with in the order of the date of occurrence, in each, of a first case.

In the following Table I. will be found a complete list, arranged chronologically, of all the ports at which ship-borne cholera was detected, and of the separate localities in England and Wales where disease of the nature of cholera appeared during 1893. The original list of inland localities reported as affected by cholera was larger than that now to be given; diminution of the list and reduction of the cases reported is due to the circumstance that in several instances inquiry, local and other, had shown the malady in question not to be cholera; but, notwithstanding this procedure, it is believed that not a few of the attacks that will be reckoned as cholera in this report were not, as a matter of fact, examples of that disease; they have been included, however, for the purpose of avoiding suggestion of understatement of cholera prevalence. The localities eliminated were 14 in number, and were as follows:—Ashton-under-Lyne, Bingley (town), Braintree, Darwen, Frislington, New Swindon, Leeds, Tavistock, Woodford, Greenwich Workhouse, Poplar, Woolwich, St. George's, Hanover Square, and St. Pancras.

In Table I. the names of the ports at which ship-borne cholera from foreign was detected are printed in italics, and the names of the metropolitan districts in small CAPITALS. In the last two columns of the Table, the pages of the report at which the history of the individual outbreak, and the results of the bacteriological examination, when made, are given respectively.

Table I.

Cholera and Reputed Cholera in England, 1893

Date of Occurrence in Locality of earliest Case reputed to be of the Nature of Cholera.	Name of Sanitary District.	Population 1891. (In case of Cholera on Shipping, Name of Vessel.)	Reported Origin of Infection.	Page of Report on which Account will be found as to— History of Out-break.	Page of Report on which Account will be found as to— Results of Bacterio-logical Examination.
June 25 -	*River Tyne Port* -	"Myrtle Branch."	Nantes	4	—
July 18 -	*Cardiff Port* - -	"Blue Jacket"	Marseilles	6	—
„ 20 -	*London Port* - -	"Altmore"	Marseilles	6	6
„ 24 -	*Liverpool Port* -	"Ant"	St. Petersburg	6	—
Aug. 2 -	*Grimsby Port* -	"Dania"	Antwerp	6	—
„ 9 -	Grimsby U. - -	51,934	?	12, 47	177, 185
„ „ -	Lincoln U. - -	41,491	Cleethorpes	13	—
„ 15 -	Cleethorpes U. -	4,306	?	13, 47	—
„ 16 -	Kingston-upon-Hull U.	200,044	?	13, 89	176, 177
„ 18 -	Shoreditch (M.) -	124,009	?	14	—
„ 23 -	*Liverpool Port* -	"Mananeuse"	Havre	7	—
„ 24 -	Rotherham U. -	42,061	Grimsby	15, 109	177
Sept. 2 -	Monk Bretton U. -	3,426	Cleethorpes	15	—
„ „ -	Tetney Parish (Louth R.).	775	Grimsby	16	—
„ 3 -	Bradford U. - -	216,361	?	16	—
„ 4 -	Middleton U. - -	22,162	?	16, 119	—
„ 5 -	Brigg U. - -	3,100	?	17	—
„ „ -	St. Margaret and St. John the Evangelist, Westminster (M).	55,539	?	17, 123	177
„ 6 -	Boston U. - -	14,593	?	17	178
„ „ -	Ashbourne U. - -	3,809	?	18, 127	180
„ „ -	Appleton - le - Street Parish (Malton R.).	151	Cleethorpes	18, 132	182
„ 6 -	St. Marylebone (M.)	142,404	?	18	18
„ 7 -	Willesden U. - -	61,265	Grimsby	19	179
„ „ -	Doncaster U. - -	25,933	Cleethorpes	19	178
„ „ -	Morton Parish (Gainsbro' R.)	1,137	?	20, 136	179
„ 8 -	Bethnal Green (M.)	129,132	?	20	—
„ „ -	Great Yarmouth U. -	49,334	?	20, 142	182
„ „ -	Clerkenwell (M.)	66,216	?	20	178, 181
„ „ -	Mansfield U. - -	15,925	Grimsby	23	180
„ 9 -	Great Clacton U. -	3,584	?	23	179
„ „ -	Leicester U. - -	174,624	Cleethorpes	23	179
„ „ -	Ilkeston U. - -	19,744	?	24, 145	182
„ „ -	Handsworth U. (Yorks).	10,295	?	24	179
„ 10 -	Fulham (M.) -	91,639	?	25, 148	179
„ „ -	South Shields U. -	78,391	?	25	26
„ „ -	East Retford U. -	10,603	?	27	179

Date of Occurrence in Locality of earliest Case reputed to be of the Nature of Cholera.	Name of Sanitary District.	Population 1891. (In case of Cholera on Shipping, Name of Vessel.)	Reported Origin of Infection.	Page of Report on which Account will be found as to—	
				History of Outbreak.	Results of Bacteriological Examination.
Sept. 11 -	Mitcham Parish (Croydon R.)	12,127	?	27	180
„ „ -	LAMBETH (M.) -	275,203	?	29	180
„ „ -	Manchester U. -	505,368	Grimsby	29	29
„ 12 -	Hurst U. - -	6,772	Cleethorpes	30	—
„ 13 -	LONDON PORT -	"Memory"	?	30	—
„ „ -	Accrington U. -	38,603	?	31	181
„ „ -	Croydon U. - -	102,695	?	32	180
„ „ -	Owston Parish (Gainsbro' R.).	1,294	Hull	33, 137	—
„ 14 -	NEWINGTON (M.) -	115,804	?	33	181
„ „ -	Derby U. - -	94,146	?	33	181
„ „ -	Stockton-on-Tees U. -	49,705	?	34	181
„ „ -	ST. LUKE (M.) -	42,440	?	35	180
„ 17 -	Blackburn U. - -	120,064	?	35	182
„ „ -	River Tyne Port -	"Jeannie"	?	36	36
„ 18 -	HACKNEY (M.) -	229,542	?	36	182
„ „ -	Liverpool U. - -	517,980	?	37	182, 184
„ „ -	North Bierley U. -	22,178	?	38, 151	185
„ „ -	*Southampton Port* -	"Glenmore"	Braila	7	—
„ 20 -	LEWISHAM (M.) -	92,647	?	38	182
„ „ -	Newcastle-on-Tyne U.	186,300	?	39	39
„ 22 -	Idle U. - - -	7,118	?	39	40
„ 23 -	*London Port* - -	"Ashbrook"	Cronstadt	7	7
„ „ -	ISLINGTON (M) -	319,143	?	40	—
„ „ -	ST. GEORGE-THE-MARTYR, SOUTHWARK, (M.)	59,712	?	40	183
„ „ -	Rowley Regis U. -	30,791	?	41, 155	183
„ 24 -	West Malling Parish (Malling R.)	2,254	?	41	184
„ 26 -	Coton Hill Lunatic Asylum, Stafford.	199	?	42, 159	184
„ 30 -	BATTERSEA (M.) -	150,558	?	42	—
Oct. 1 -	*River Blyth Port* -	"Ashbrook"	Cronstadt (London.)	8	—
„ 2 -	Crondall Parish (Hartney Wintney R.)	3,898	?	42	185
„ 3 -	Gloucester U. -	39,444	?	43	184
„ 6 -	Ormskirk U. - -	6,298	?	43	185
„ 7 -	Balby Parish (Doncaster R.)	4,270	?	44	185
„ 9 -	Rawmarsh U. - -	11,983	Rotherham.	44	186
„ 13 -	Keighley U. - -	30,810	?	45	186
„ 16 -	Warrington U. -	52,743	?	45	186
„ „ -	Bingley Township U.	10,023	?	46	186

From the above table it will be observed that up to the *first week in August* cases of cholera from foreign were detected on shipboard at the five ports of River Tyne, Cardiff, London, Liverpool, and Grimsby, but that no cases of reputed choleraic disease are known to have made their appearance amongst the resident population until the *second week in August*, when cases were reported to have occurred at Grimsby, Lincoln, and Cleethorpes, all places situate in Lincolnshire. During the second half of August disease, presumably cholera, appeared at Hull and Rotherham in Yorkshire, and at Shoreditch in the metropolis. Thus during August disease of the nature of cholera appeared in five towns or villages situate in Lincolnshire and Yorkshire, and in one metropolitan area. During the month of September appearances of choleraic disease were reported to have taken place in 50 additional localities situate in the following counties: Lincolnshire, 5; Yorkshire, 7; Lancashire, 6; Derbyshire, 3; Nottinghamshire, 2; Durham, 2; Surrey (extra metropolitan), 2; Northumberland, 2; Staffordshire, 2; Middlesex (extra metropolitan), 1; Norfolk, 1; Essex, 1; Leicestershire, 1; Kent (extra metropolitan), 1; and Metropolitan Districts, 14. During the month of October the appearance of disease of the nature of cholera was reported from eight additional localities situate in the following counties: Yorkshire, 4; Lancashire, 2; Hampshire, 1; and Gloucestershire, 1. After October 17th, choleraic disease was not reported to have appeared in any new locality in the country. From the above notes it will be seen that disease reputed to be cholera appeared in 64 separate localities of the Kingdom, of which 49, situate in 16 counties, were extra metropolitan, and 15 were metropolitan districts. In more than three-fifths of the localities where these attacks occurred the disease was limited to a single case.

(*a.*) *Cholera detected on Vessels arriving in England "from Foreign" during* 1893.

During 1893, notwithstanding the prevalence of cholera at numerous Continental ports having trade with this country, only 13 cases of cholera, or disease suspected to be cholera, were detected on board or connected with vessels from foreign. A list of these cases, with certain details, is given in Table II. on page 5.

These 13 cases entered the country at seven ports, namely, London 4, Liverpool 3, Cardiff 2, and the River Tyne, River Blyth, Grimsby, and Southampton 1 at each. Nine of the cases were reported between July 18th and August 23rd, two during the month of September, and one each during the months of June and October. Of the 13 cases 4 proved fatal.

The reputed source of infection in the 13 cases was as follows:—Marseilles 4, Cronstadt 2, St. Petersburg 2, Nantes 1, Cherbourg 1, Antwerp 1, Havre 1, and Sulina 1.

On June 25th the SS. "Myrtle Branch" (20 hands) arrived at the River Tyne Port from Nantes, which she had left June 20th. On her arrival it was reported that one of the crew had died three hours before her arrival after an attack having symptoms suspicious of cholera. Upon receiving an account of the history of the attack and after an examination of the corpse, the Assistant Port Medical Officer of Health had no hesitation in attributing the death to Asiatic cholera. The corpse was accordingly removed to the mortuary at the Port Floating Hospital, and the ship was sent to the mooring station to undergo the necessary measures of disinfection. No further spread of the disease was reported. The water-supply of this vessel had been obtained from the River Loire on June 7th, at a point between Nantes and St. Nazaire.

Table II.

Cholera detected on Vessels arriving at English Ports from Foreign during 1893.

No. of Case.	Date of Arrival in England (a), or of Attack by Cholera (b), whichever Event occurred latest in Point of Time.	Sanitary District whence Case notified.	Facts with respect to Vessel.					Sex of Patient.	Facts with respect to Persons attacked with Cholera.				
			Name of Vessel.	Port of Departure.		Port of Arrival.			Date of Cholera Attack.	Place of Attack.	Where isolated.	Date of isolation.	Result.
				Name.	Date.	Name.	Date.						
	1893.												
1	June 25 (a)	River Tyne Port	"Myrtle Branch."	Nantes	June 20	River Tyne	June 25	M	June 25	At sea	- - -	—	Died June 25.
2	July 18 (a)	Cardiff Port	"Blue Jacket"	Marseilles	July 9	Cardiff	July 18	M	July 9	"	Cardiff Port Hospital, Flatholm.	July 19	Recovered.
3	" 18 (a)	" "	" "	"	" "	"	" "	M	" 15	"	" "	" "	"
4	" 20 (a)	London Port	"Altmore"	"	" 3	London	" 20	M	" 5	"	London Port Hospital.	" 20	"
5	" 24 (a)	Liverpool Port	"Ant"	St. Petersburg, Dieppe	June 27, July 21	Liverpool	" 24	M	June 29	"	Liverpool Port Hospital.	" 25	"
6	" 24 (a)	" "	"	" "	"	"	" "	M	July 23	"	" "	" 25	"
7	" 26 (b)	St. George in the East Urban (London).	"Altmore"	Marseilles	" 3	London	" 20	M	" 26	16, Raymond Street, Wapping.	London Port Hospital.	" 26	"
8	Aug. 2 (a)	London Port	"Elizabeth McLea."	Cherbourg	" 31	"	Aug. 2	M	Aug. 1	At sea	" "	Aug. 2	"
9	" 2 (a)	Grimsby Port	"Dania"	Antwerp	" 30	Grimsby	" 2	M	July 30	"	Grimsby Port Hospital.	" 3	Died Aug. 3.
10	" 23 (b)	Liverpool Urban.	"Mananeuse"	Brazil, Havre	" 22, Aug. 20	Liverpool	" 23	M	Aug. 23	171, Grafton Street, Liverpool.	Park Hill Hospital.	" 23	Recovered.
11	Sept. 18 (a)	Southampton Port.	"Glenmore"	Braila, Sulina	" 18, " 27	Southampton	Sept. 18	M	" 30	At sea	Southampton Port Hospital.	Sept. 18	"
12	" 23 (a)	London Port	"Ashbrook"	Cronstadt	Sept. 14	London	" 23	M	Sept. 17	"	London Port Hospital.	" 23	Died Sept. 23.
13	Oct. 1 (a)	River Blyth Port.	"	Cronstadt, London	" 14, " 30	River Blyth	Oct. 1	M	" 30	"	River Blyth Port Hospital.	Oct. 1	Died Oct. 1.

On July 18th, the SS. "Blue Jacket" (22 hands) arrived at Cardiff from Marseilles, which place she had left on July 9th. On being boarded by the Assistant Port Medical Officer of Health the captain reported that two of the crew, who had been attacked with violent vomiting and diarrhœa two days after leaving Marseilles, were still unwell. From the history of the cases, and after an examination of the patients, the Port Medical Officer was of opinion that both men were convalescing from attacks of cholera. They were accordingly at once removed to the Port Sanitary Authority's hospital on the Flat Holm Island, where they subsequently recovered. The vessel was sent to the mooring station, and after disinfection was allowed to proceed to her destination.

On July 20th the SS. "Altmore" (25 hands, 4 passengers) arrived at the Port of London, having left Marseilles on July 3rd, and Havre on July 16th. Upon medical inspection it was ascertained that on July 5th, two days after leaving Marseilles, a fireman who had been on shore there, had sickened with symptoms characteristic of cholera. When the vessel arrived off Gravesend this man had returned to duty, but was found to be still ailing and so weak that the Port Medical Officer of Health directed his removal to the Port Sanitary Authority's hospital, where he ultimately recovered. Some of the dejecta from this patient were submitted for bacteriological examination to Dr. Macfadyen of the College of State Medicine, and he reported the presence of Koch's comma-bacilli. The "Altmore" was taken to the mooring station, where the necessary measures of disinfection were carried out, the water tanks emptied and cleansed, and the bilges washed out with a solution of perchloride of mercury. A second case which occurred in connexion with this vessel on July 26th will be noticed later.

On July 24th the SS. "Ant" (20 hands, 2 passengers) arrived at the Port of Liverpool, having left St. Petersburg on June 27th, and touched at Stromness July 13th, and Dieppe July 21st. Upon medical inspection, it was ascertained that two men had been ill on the voyage, (*a*) a stoker who had been attacked with choleraic symptoms on June 29th, two days after leaving St. Petersburg, and who had suffered more or less from diarrhœa until the arrival of this vessel at Liverpool, when he was found to be in a very debilitated condition; and (*b*) another stoker who had sickened with choleraic symptoms on July 23rd, the day before the vessel reached Liverpool. The Port Medical Officer of Health directed the removal of both men to the Port Sanitary Authority's hospital at New Ferry, where they ultimately recovered. The vessel was subjected to the necessary measures of disinfection and no further cases were reported.

On July 26th a case of suspected cholera was reported to have occurred at Raymond Street, Wapping, St. George's-in-the-East, in the person of a labourer, who had been employed on the SS. "Altmore," already referred to. Upon examination by the Port Medical Officer of Health, it was found that this man was suffering from diarrhœa, severe abdominal pain, and cramps in the legs. As the case was suspicious in character, the patient was at once removed to the Port Sanitary Authority's hospital, where he recovered. Work was stopped on board the "Altmore" and further disinfection carried out. No more cases were reported.

On August 2nd, the SS. "Dania" (8 hands), a vessel bound from Antwerp to Iceland, put into the Roads at Grimsby for the purpose of landing the engineer, who had been attacked on July 30th with symptoms

characteristic of cholera. The Port Medical Officer of Health after examination of the patient decided that he should be removed to the floating hospital of the Port Sanitary Authority; this, however, was not ready, and it was not until 1 p.m. on August 3rd that the removal could be effected. The patient died the same evening. The "Dania" was sent to the mooring station, and after disinfection, was allowed to proceed on her voyage to Iceland.

On August 2nd also, the schooner "Elizabeth McLea" (5 hands) arrived at Sheerness, Port of London, from Cherbourg, having left the latter port on July 31st. On her arrival it was reported that the mate, who had been on shore at Cherbourg, had sickened on August 1st with symptoms characteristic of cholera. He was removed to the Port Sanitary Authority's hospital, where in the end he recovered. Upon bacteriological examination of the dejecta of this patient by Dr. Macfadyen the presence of Koch's comma-bacillus was demonstrated. The vessel was sent to the mooring station for disinfection and no further cases were reported.

On August 23rd, at 1 a.m., the SS. "Mananeuse" (43 hands, 19 passengers) arrived at Liverpool from the Brazils *viâ* Lisbon and Havre, having left the two last-named ports on August 15th and August 20th respectively. On arrival it was reported that all on board were well, and the vessel entered the Brunswick Dock. At 4 p.m. a seaman on board was seized with vomiting, purging, and cramps in the belly and limbs. The Port Medical Officer of Health, on visiting the vessel, found that the patient had been removed to his house at 171, Grafton Street, Liverpool. He visited him there, and, regarding the case to be suspicious of cholera, caused his removal to the Park Hill Hospital, whence he was discharged cured on August 26th. The vessel was dealt with in the usual way, and no further cases were reported.

On September 18th the SS. "Glenmore" (23 hands) arrived at Southampton, having left Galatz on August 25th and Sulina on August 27th. Shortly after leaving the latter port several of the crew were reported to have suffered from severe diarrhœa; and upon medical inspection at Southampton a fireman who had been attacked on August 30th with characteristic choleraic symptoms was found to be still ill and very weak. He was accordingly at once removed to the Port Sanitary Authority's hospital, where he finally recovered. The "Glenmore" was thoroughly disinfected, and no further cases were reported.

On September 23rd the SS. "Ashbrook" (18 hands, 1 passenger) reached the Port of London from Cronstadt, having left the latter port on September 14th. Upon arrival it was ascertained that one of the crew, a "donkeyman," had sickened on September 17th with characteristic choleraic symptoms, and the Port Medical Officer of Health as the result of his personal examination of the patient was of opinion that he was suffering from Asiatic cholera. The patient was at once removed to the Port Sanitary Authority's hospital, where he died the same day. Upon bacteriological examination of some of the soiled linen belonging to the deceased, Dr. Macfadyen succeeded in demonstrating the presence of Koch's comma-bacilli. The "Ashbrook" was submitted to the usual disinfection, and after having discharged her cargo and taken in fresh water left the Port of London on September 30th for that of the River Blyth, in Northumberland.

On October 1st the SS. "Ashbrook," referred to in the last paragraph, arrived at the River Blyth Port, and it was then found that a man who had travelled in her from Cronstadt to London as a consular passenger, and who had joined the crew in London as a "coal trimmer," was, on arrival at the River Blyth, suffering from symptoms characteristic of cholera. The patient, who was in a state of collapse on arrival, had been attacked on the day (September 30th) the "Ashbrook" left London; he was at once, under instructions from the Port Medical Officer of Health, removed to the South Blyth Urban Sanitary Authority's hospital, where he died on October 2nd. The vessel was sent to the mooring station for disinfection, and no further cases were reported.

The master of the "Ashbrook" was prosecuted by the River Blyth Port Sanitary Authority on the ground that he, "being the master of a "ship called the 'Ashbrook,' then infected with cholera, did not, when "within three miles of the coast of England, to wit, Blyth, cause to be "hoisted the commercial code signal Q, being a yellow flag, under the "national ensign, and did not keep the same displayed during the hours "between sunrise and sunset on Sunday the 1st October" in accordance with the regulations contained in Section III. Article 19 of the Board's Cholera Order of 28th August 1890. The defendant was convicted and fined 10*l.* and 2*l.* 10*s.* 6*d.* costs.

The topographical situation of the ports at which cases of cholera "from foreign" were detected in 1893 is indicated in the annexed Map I.

In addition to the vessels named above, which were reported to have actually had cholera cases on board on their arrival, a number of vessels reached the ports of this country in 1893, as in the previous year, on which cases of cholera had occurred on the voyage. In all cases the usual procedure followed at English ports was carried out, the vessel in each instance being sent to the appointed mooring station for disinfection, and all persons on board, who, on medical examination were found to be free from suspicion of cholera, allowed to land at once upon furnishing the Port Medical Officer of Health with their names and addresses.

(*b.*) *Reputed Cholera among English Communities.*—I have already referred to the fact that in 1893 disease of the nature of cholera was reported to have appeared in England in 64 separate localities, and in the following pages I propose to give a detailed account of such of those appearances as were not the subject of special inquiry by one or another of the Board's medical staff, and with regard to which, detailed reports are included in this volume. In the latter class of cases short notes only of the outbreaks are given, the reader being referred for details to the complete reports. The topographical position of the several localities in which cholera was reported to have appeared in 1893 is shown in Map II.

In the following Table III. is shown the total number of attacks and of deaths referred to cholera in each locality where it was reported to have appeared in 1893. The rates of attack and of death per 10,000 of the population of the districts in which the cases occurred are also given.

Cholera in England and Wales 1893.

Map I.

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CHOLERA IN ENGLAND & WALES 1893.

Map II.

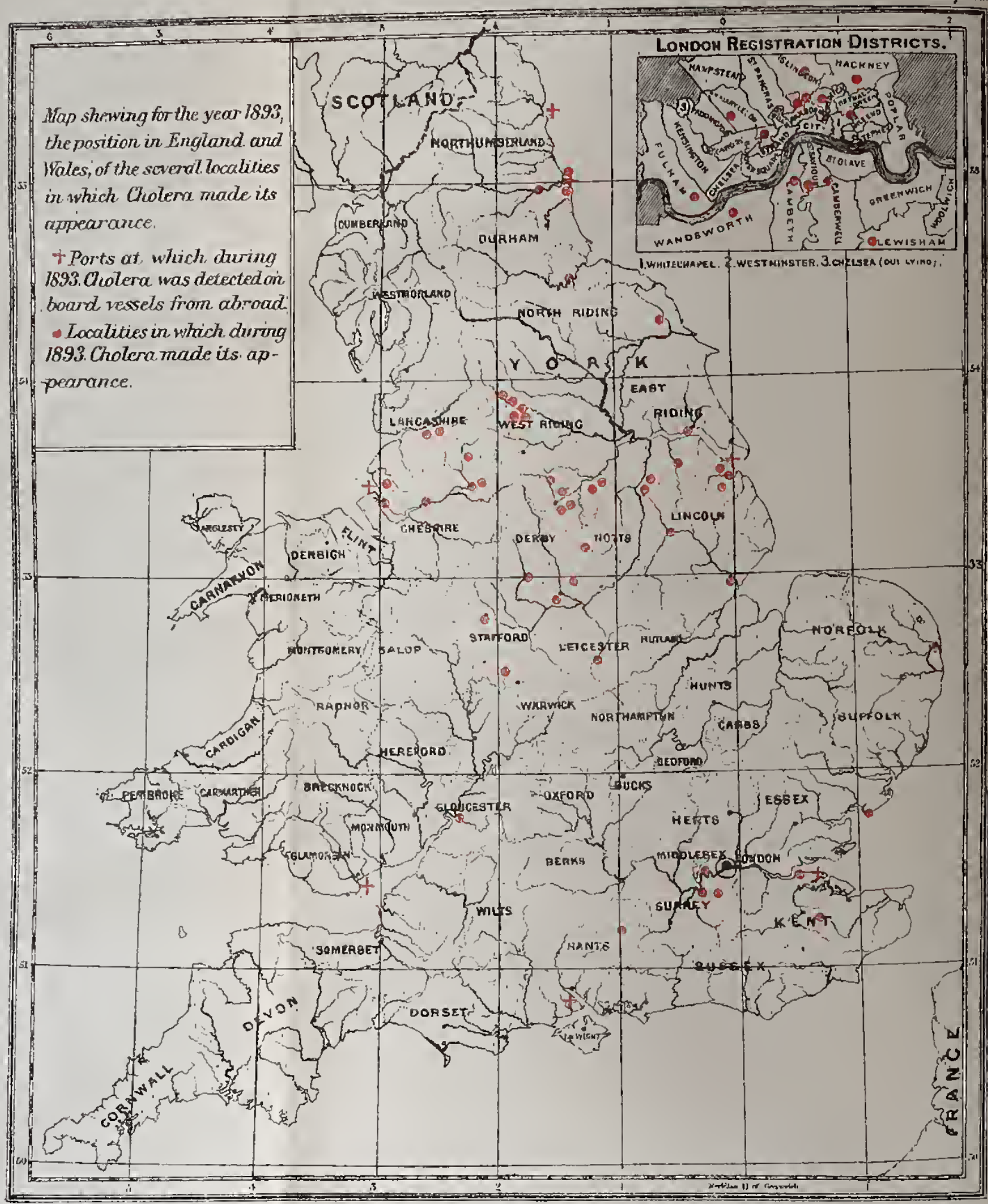

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Table III.

Showing the Number of Attacks and of Deaths referred to Cholera in English Communities in 1893.

[*In this Table rates taken on single attacks or single deaths respectively are placed in square brackets.*]

(*a.*) *In extra Metropolitan Districts.*

County.	Locality in which reputed Cholera appeared in 1893.	Population, Census 1891.	Date of onset of First Case reputed to be Cholera.	Total reputed Cholera		Rate, per 10,000 of Population. Cholera	
				Attacks.	Deaths.	Attacks.	Deaths.
Lincolnshire	Grimsby	51,934	9 Aug.	127	35	24·5	6·7
	Lincoln	41,491	9 „	1	1	[0·2]	[0·2]
	Cleethorpes	4,506	15 „	11	7	25·5	16·5
	Tetney (Louth R.)	775	2 Sept.	1	1	[129·0]	[129·0]
	Brigg	3,100	5 „	1	1	[33·4]	[33·4]
	Boston	14,593	6 „	1	1	[0·7]	[0·7]
	Morton (Gainsborough R.)	1,137	7 „	1	1	[8·8]	[8·8]
	Owston Ferry (Gainsborough R.)	1,294	13 „	1	1	[7·7]	[7·7]
Yorkshire	Kingston-upon-Hull	200,044	16 Aug.	17*	12*	0·8	0·6
	Rotherham	42,061	24 „	3†	2†	0·7	0·5
	Monk Bretton	3,426	2 Sept.	1	1	[2·9]	[2·9]
	Bradford	216,361	3 „	1	1	[0·05]	[0·05]
	Appleton-le-Street (Malton R.)	151	6 „	5	3	331·0	199·0
	Doncaster	25,933	7 „	1	1	[0·4]	[0·4]
	Handsworth	10,295	10 „	1	1	[1·0]	[1·0]
	North Bierley	22,178	18 „	7	6	3·2	2·7
	Idle	7,118	22 „	1	—	[1·4]	—
	Balby (Doncaster R.)	4,270	7 Oct.	2	1	4·7	[2·3]
	Rawmarsh	11,983	10 „	1	1	[0·8]	[0·8]
	Keighley	30,810	12 „	3	2	1·0	0·65
	Bingley	10,023	17 „	1	1	[1·0]	[1·0]
Lancashire	Middleton	22,162	4 Sept.	3	2	1·4	0·9
	Manchester	505,368	11 „	4	2	0·08	0·04
	Hurst	6,772	12 „	1	1	[1·5]	[1·5]
	Accrington	38,603	13 „	2	2	0·5	0·5
	Blackburn	120,064	17 „	1	1	[0·08]	[0·08]
	Liverpool	517,980	18 „	2	2	0·04	0·04
	Ormskirk	6,298	6 Oct.	1	1	[1·6]	[1·6]
	Warrington	52,743	13 „	1	1	[0·2]	[0·2]
Derbyshire	Ashbourne	3,809	6 Sept.	15	9	39·4	23·6
	Ilkeston	19,744	9 „	4	3	2·0	1·5
	Derby	94,146	14 „	1	1	[0·1]	[0·1]
Middlesex (extra Metropolitan.)	Willesden	61,265	7 „	1	1	[0·2]	[0·2]
Norfolk	Great Yarmouth	49,334	8 „	4	3	0·8	0·6

* In addition there were reported 152 cases of choleraic diarrhœa, of which 7 were fatal.
† In addition there were reported 18 cases of choleraic diarrhœa, of which 1 was fatal.

County.	Locality in which reputed Cholera appeared in 1893.	Population, Census 1891.	Date of onset of First Case reputed to be Cholera.	Total reputed Cholera		Rate per 10,000 of Population. Cholera	
				Attacks.	Deaths.	Attacks.	Deaths.
Essex	Great Clacton	3,584	8 Sept.	11	1	30·7	[2·8]
Leicestershire	Leicester	174,624	9 „	1	1	[0·06]	[0·06]
Nottinghamshire.	Mansfield	15,925	9 „	1	1	[0·6]	[0·6]
	East Retford	10,603	10 „	1	1	[1·0]	[1·0]
Durham	South Shields	78,391	10 „	2	2	0·2	0·2
	Stockton-on-Tees	49,705	14 „	1	1	[0·2]	[0·2]
Surrey (extra Metropolitan.)	Mitcham (Croydon R.)	12,127	11 „	1	—	[0·8]	—
	Croydon	102,695	13 „	1	1	[0·1]	[0·1]
Northumberland.	River Tyne	—	17 „	1	1	—	—
	Newcastle-on-Tyne	186,300	20 „	4	2	0·2	0·1
Kent (extra metropolitan.)	West Malling (Malling R.)	2,254	24 „	1	1	[4·4]	[4·4]
Staffordshire	Rowley Regis	30,791	25 „	8	2	2·6	0·65
	Coton Hill Asylum	199	26 „	2	2	—	—
Hampshire	Crondall (Hartley Wintney R.)	3,898	2 Oct.	6	—	15·4	—
Gloucestershire	Gloucester	39,444	3 „	1	1	[0·2]	[0·2]

(b.) *In Metropolitan Districts.*

—	Metropolitan Areas in which reputed Cholera appeared in 1893.	Population, Census 1891.	Date of onset of First Case reputed to be Cholera.	Total reputed Cholera		Rate per 10,000 of Population. Cholera	
				Attacks.	Deaths.	Attacks.	Deaths.
Metropolitan Districts.	Shoreditch	124,009	18 Aug.	1	1	[0·08]	[0·08]
	St. Margaret and St. John the Evangelist, Westminster.	55,539	5 Sept.	1	1	[0·2]	[0·2]
	St. Marylebone	142,404	7 „	1	1	[0·07]	[0·07]
	Bethnal Green	129,132	8 „	1	1	[0·08]	[0·08]
	Clerkenwell	66,216	8 „	3	—	0·5	—
	Fulham	91,639	10 „	1	1	[0·1]	[0·1]
	Lambeth	275,203	10 „	1	1	[0·04]	[0·04]
	London Port	—	13 „	1	—	—	—
	Newington	115,804	14 „	1	1	[0·08]	[0·08]
	St. Luke	42,440	14 „	1	—	[0·2]	—
	Hackney	229,542	18 „	1	—	[0·04]	—
	Lewisham	92,647	20 „	1	—	[0·1]	—
	Islington	319,143	23 „	1	—	[0·03]	—
	St. George the Martyr, Southwark.	59,712	23 „	1	1	[0·2]	[0·2]
	Battersea	150,558	30 „	1	1	[0·07]	[0·07]

From the above table it will be seen that, although disease presumed to be cholera appeared in 64 towns, villages, or hamlets, in only 22 of the 64 did there occur plurality of cases. Further it appears that in not more than 5 of the 23 did the number of attacks exceed 10,

namely, in Grimsby, 127; Kingston-upon-Hull, 17; Ashbourne, 15; Cleethorpe-with-Thrunscoe, 11; and Great Clacton, 11.*

The total number of persons attacked with illness deemed to be of the nature of cholera in England in 1893 (exclusive of ship-borne cases), was 287, and of these 135, or 47 per cent., died.

In Table IV. the above cases and deaths are referred to the counties in which they occurred, and rates are taken in each instance on the total populations implicated. For England and Wales and for London, attack-rates and death-rates calculated, in each instance, on the total population, are appended to the Table.

Table IV.

Showing the Number of Attacks and of Deaths referred to Cholera in 1893 in the several Counties of England in which such Cases appeared.

[*In this Table, rates taken on single attacks or single deaths respectively are placed in square brackets.*]

County.	Date of Onset of First Case reputed to be Cholera.	Number of Localities where Disease appeared.	Population of Communities attacked (Census 1891).	Total reputed Cholera.		Rates per 10,000 of the Population.	
				Attacks.	Deaths.	Attacks.	Deaths.
Lincolnshire - -	9 Aug.	8	118,630	144	48	*12·1*	*4·0*
Yorkshire - - -	16 „	13	584,653	44	32	*0·75*	*0·55*
Lancashire - -	4 Sept.	8	1,269,990	15	12	*0·1*	*0·09*
Derbyshire - -	6 „	3	117,699	20	13	*1·7*	*1·1*
Middlesex (extra-Metropolitan).	7 „	1	61,265	1	1	[*0·2*]	[*0·2*]
Norfolk - - -	8 „	1	49,334	4	3	*0·8*	*0·6*
Essex - - -	8 „	1	3,584	11	1	*30·7*	[*2·8*]
Leicestershire - -	9 „	1	174,624	1	1	[*0·06*]	[*0·06*]
Nottinghamshire -	9 „	2	26,528	2	2	*0·75*	*0·75*
Durham - - -	10 „	2	128,396	3	3	*0·2*	*0·2*
Surrey (extra-Metropolitan).	11 „	2	114,822	2	1	*0·1*	[*0·07*]
Northumberland - -	17 „	2	186,300	5	3	*0·3*	*0·2*
Kent (extra-Metropolitan)	24 „	1	2,254	1	1	[*4·4*]	[*4·4*]
Staffordshire - -	25 „	2	30,990	10	4	*3·2*	*1·3*
Hampshire - -	2 Oct.	1	3,898	6	—	*15·4*	—
Gloucestershire - -	3 „	1	39,444	1	1	[*0·2*]	[*0·2*]
Total extra-Metropolitan Districts -		49	2,912,411	270	126	*0·9*	*0·43*
Metropolitan Districts -	18 Aug.	15	1,893,979	17	9	*0·08*	*0·045*
Total England - -		64	4,806,390	287	135	*0·6*	*0·3*

Rates of Reputed Cholera Attack and Death in 1893, calculated on the Total Population.

England and Wales - - -	29,002,525	287	135	0·1	0·05
London - - - - - -	4,211,743	17	9	0·04	0·002

* As regards Great Clacton it may be noted that, although included in the list, the outbreak possessed few of the characteristics of true cholera, as will be seen from a study of the details given at page 23.

Assuming that all the deaths referred to cholera were, as matter of fact, examples of that disease, comparison of the cholera mortality of England and Wales in 1893 with similar mortality in this country in 1848, 1849, 1853, 1854, 1865, and 1866, the only years in which cholera has appeared in this country since registration of deaths has been enforced, suffices to demonstrate the comparatively insignificant dimensions of the recent prevalence here of the malady.

Table V. makes such comparison, and shows that in 1893 the cholera death-rate of England and Wales was $\frac{1}{136}$th, and the cholera death-rate of London was $\frac{1}{920}$th, the corresponding rates recorded for 1866, the last occasion on which cholera was epidemic among our populations.

Table V.

Mortality Statistics of Cholera recorded in England and Wales and in London respectively in Years when Cholera has appeared in England in Registration times.

Date.	England and Wales.		London.	
	Total Deaths.	Deaths per 10,000 Living.	Total Deaths.	Deaths per 10,000 Living.
1848	1,908	1·1	652	2·9
1849	53,293	30·3	14,137	61·8
1853	4,419	2·4	883	3·5
1854	20,097	10·9	10,738	42·8
1865	1,297	0·6	196	0·6
1866	14,378	6·8	5,596	18·4
1893	135*	0·05	9*	0·002

* These figures, it should be borne in mind, will not, having regard to the facts noted in paragraph 4, page 1, *post*, be found to correspond with the figures hereafter to be published by the Registrar General.

Before passing to the consideration in detail of the several cholera occurrences in this country during 1893, I submit Maps III.–VIII., showing the distribution in time of the observed cholera in 1893 throughout the country. Map III. deals with the period from the first appearance of cholera in 1893 to September 2nd; Maps IV., V., VI., and VII. with successive weeks in September; and Map VIII. with the period from October 1st to the end of the year.

Great Grimsby.

On August 9th, a dock labourer, aged 49 years, living in Trinity Street, *Great Grimsby* (Lincolnshire), was attacked with choleraic illness, and died on August 11th, 40 hours after the onset of the disease. This death was certified as "cholera nostras." Between August 11th and August 30th 12 more fatal cases of a choleraic nature occurred in the town; of these 12 deaths, 3 were certified as from "diarrhœa," 6 as from "cholera nostras," 2 as from "English cholera," and 1 as from "choleraic diarrhœa." In consequence of the reported occurrence of these suspicious cases, Dr. Reece was sent to Grimsby on August 29th, to make inquiry into the matter on behalf of the Board. In the case of two further deaths, which took place on August 30th and 31st respectively, after similar illnesses to those observed in the earlier cases, samples of the bowels and dejecta of the patients were forwarded to Dr. Klein for bacteriological examination

(*see* Appendix B., page 177, Materials II. and III.). Dr. Klein reported in both cases that the results obtained were indicative of true cholera. The prevalence of choleraic illness persisted in Grimsby until October 14th. During the whole period, from August 5th to October 14th, 127 persons were reported to have been attacked at Grimsby with illness of the nature of cholera, and in 35 instances fatal results followed. During the same period, in addition to these cases, which in the majority of instances must be regarded as true cholera, a large number of persons were reported to have suffered from diarrhœa, which proved fatal in 81 instances. Many of the "diarrhœa" cases are said to have been "infective," and to have had symptoms somewhat suspicious of cholera. As regards two of the "diarrhœa" cases, samples of the dejecta were submitted to Dr. Klein for bacteriological examination (*see* Appendix B., page 185, Materials XLVI. and XLVII.). In both these cases Dr. Klein reported that the results of his examinations were negative as regards the presence of Koch's comma bacillus.

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Dr. Reece's detailed report of his inquiry into the circumstances of the outbreak at Great Grimsby, will be found in Appendix A., No. 2, page 47.

Lincoln.

On August 9th, a person residing at *Lincoln* (Lincolnshire) was attacked with symptoms suspicious of cholera. The history of the case, as obtained from local sources, may be summarised as follows:—H. B., female, aged 36 years, living in Ripon Street, Lincoln, a delicate woman subject to attacks of diarrhœa, went on July 29th to Cleethorpes and Grimsby and returned to Lincoln on August 5th apparently quite well. On August 8th she again went with a friend to Cleethorpes by a trip, returning the same night. On August 9th she was attacked with vomiting and diarrhœa, pain in the abdomen, and cramps. The evacuations are stated to have been watery and greenish yellow in colour. The urine, though not suppressed, was stated to have been small in quantity. The patient continued ill on August 10th and died on August 11th. The friend who was with her at Cleethorpes did not suffer from diarrhœa. The deceased is stated to have been fond of oysters, and to have brought some home with her on August 8th. Precautions as to disinfection of drains, &c., are said to have been taken, and no further cases were reported from Lincoln. The occurrence of this case was not reported to the Board by the local authorities, the first intimation of its having taken place being received on September 1st from the Board's inspector, Dr. Reece, who was at that time making inquiry as to the outbreak of cholera at Grimsby and who heard of it there. Efforts to obtain more complete details have failed.

Cleethorpe-with-Thrunscoe.

On August 15th, the first reported case of a series of eleven attacks of choleraic illness, of which seven proved fatal, occurred at *Cleethorpe-with-Thrunscoe* (Lincolnshire), a sanitary district adjoining Grimsby. This outbreak was investigated by Dr. Reece, whose detailed report will be found in Appendix A., No. 2, page 47. All the attacks occurred in the period August 15th—September 8th. Bacteriological examination was not made with respect to any of the cases at Cleethorpes but the clinical history of the persons attacked was consistent with that of true cholera.

Kingston-upon-Hull.

On August 16th, a man aged 61 years, living in a common lodging-house at *Kingston-upon-Hull* (Yorkshire), was attacked with choleraic symptoms, from which, however, he recovered. On August 24th, a boy, aged 11 years, residing in a house situate in the same quarter of the town as the patient referred to above, was attacked with suspicious

symptoms, and died the same day after an illness of under ten hours. A piece of the ileum of this patient was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 176, Material I.). Dr. Klein reported as the result of his examination that the appearances were typical of true cholera. Subsequently, between August 24th and October 12th, 168 cases of a choleraic nature (16 certified as "cholera" and 152 as "choleraic diarrhœa") were reported of which 16 died (11 "cholera" and 5 "choleraic diarrhœa"). As regards another of the fatal cases certified to be due to "cholera," a piece of ileum was examined bacteriologically by Dr. Klein (*see* Appendix B., page 177, Material IV.), and here, as in the first case examined, Dr. Klein reported that the appearances were typical of true cholera. The circumstances of this outbreak were made the subject of a special inquiry on behalf of the Board by Dr. Theodore Thomson, whose detailed report will be found in Appendix A., No. 3, page 89.

Shoreditch.

On August 19th, a telegram was received by the Board from the Vestry Clerk of *Shoreditch* (London) that a death from "cholera" had been notified there that day. This being the first case of cholera reported as occurring in any Metropolitan District in 1893, Dr. Horne, one of the Board's medical inspectors, was instructed to inquire into the circumstances of the case. He reported the case to be that of G. F. H., male, aged 10½ years, residing in Wimbourne Street, Hoxton, Shoreditch. He was a sturdy, healthy child, and had been apparently in perfect health until August 18th. In the morning of that day he had tea and bread and butter for breakfast. After being out at play most of the morning he went home to dinner, which meal consisted of pease pudding and bread. About 2 p.m. he went for a ride in a covered van with a friend of his father's and another boy, who were engaged in delivering parcels of woollen goods in the City. He remained with them until about 6 p.m. About 5 p.m., while in the van, he complained of feeling unwell, and had an attack of vomiting. On reaching home he was at once attacked with purging and vomiting, and complained of great pain in the chest and abdomen. Medical aid was obtained between 7 and 8 p.m. The medical man who was called in stated that he found the patient lying upon his side with his lower limbs drawn up, in a state of collapse and semi-consciousness. He resented being touched, and groaned loudly, as though in great agony. The surface of his body was cold, and his face was livid and "drawn." He discharged copious "rice-water" evacuations from the bowels at 8.30 p.m. On August 19th, the patient was stated to have been quite unconscious, cold and livid, with his limbs "drawn up with cramps more than on the previous night." He died in this condition about 9.30 a.m. A post-mortem examination was made at 4 p.m. on August 19th, with the following results:—The body, which was well nourished, was not quite cold; rigor mortis was incomplete; the face had a pinched appearance, and the lips and nose were dark; on turning the head on one side a little yellowish fluid trickled from the mouth; hypostatic staining was well marked over the back and dependent parts; the thoracic organs were apparently normal; no pathological change was observed on the external surfaces of the stomach and intestines. The stomach contained about an ounce of pultaceous bile-stained liquid; the mucous membrane was slightly swollen, and at the cardiac end there were vascular streaks, which were most marked on the lesser curvature. The intestines were not opened. The stomach and intestines, together with portions of other organs, were reserved for detailed examination, which, however, was not made, owing to the fact that these organs were detained by the

Coroner until decomposition had become advanced. No evidence could be obtained of the deceased having associated prior to his illness with any person who had come from a cholera-infected place, nor of his having eaten any food from abroad, nor of the occurrence of any similar illness among the neighbours in the street where deceased had lived.

On August 22nd the death of a man at Singleton Street, Shoreditch, was notified to the Board as "probably due to cholera," and Dr. Horne was consequently directed to make inquiry into the circumstances of the case. After careful consideration of the clinical history and of the results of a post-mortem examination, Dr. Horne reported that in his opinion the disease was not cholera. No further cases were reported from the district.

Rotherham.

On August 24th a woman, aged 29 years, residing at *Rotherham* (Yorkshire), died after a few hours' illness, the symptoms of which are stated to have been abdominal pains and collapse, without sickness or diarrhœa. This woman had, with several friends, spent the preceding day (August 23rd) at Grimsby and Cleethorpes, where cholera was then occurring. Of the party she alone had eaten oysters on the sands at Cleethorpes. On September 5th a collier, aged 31 years, residing in a house about 800 yards distant from that occupied by the patient referred to above, was attacked with choleraic symptoms and died the same day. A portion of the ileum of this patient was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 177, Material V.). As a result of his examination Dr. Klein reported the presence of Koch's comma-bacillus. Subsequently, between September 11th and October 18th, 20 cases of a choleraic nature (2 certified as "cholera" and 18 as "choleraic diarrhœa") were reported, of which 2 proved fatal (1 "cholera," 1 "choleraic diarrhœa"). As regards two of the cases certified as "choleraic diarrhœa," bacteriological examination was made of the stools by Dr. Sims Woodhead, and in both instances the results were stated to be indistinguishable from true cholera. The circumstances of this outbreak were made the subject of a special inquiry on behalf of the Board by Dr. Theodore Thomson, whose detailed report will be found in Appendix A., No. 4, page 109.

Monk Bretton.

On September 2nd a person residing at *Monk Bretton* (Yorkshire) was attacked with choleraic symptoms early in the morning and died on the evening of the same day. The history supplied by the medical attendant (Mr. M. C. Sykes) was as follows:—M. S., female, aged 65 years, married, living at Hill Top, Monk Bretton, was attacked about 5.30 a.m. on September 2nd with vomiting and diarrhœa, followed by cramps in the limbs. The patient was first seen by her medical attendant about 9.30 a.m.; at that time she was suffering from severe abdominal pain, not relieved by pressure; cramps in the legs, feet, abdomen, and thighs; cold hands, feet, and face; cyanosis; cold perspiration standing in drops on face and head; shallow breathing; abdomen retracted; total suppression of urine; persistent purging and vomiting; motions "rice water" in character; vomiting of watery fluid; mind clear; temperature in axilla, subnormal; pulse imperceptible at the wrist, ankles, and temporals; voice reduced to whisper; great thirst; patient in state of general collapse. At 7.45 p.m. the patient was in a condition of extreme collapse; feet and hands markedly contracted and claw-like. She died at 8.45 p.m. No post-mortem or bacteriological examination was made in this case. The patient is stated to have been staying at Cleethorpes shortly before her attack, but the exact date is not known. Measures of disinfection were taken and no further cases were reported.

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On Cholera in England and Wales in 1893; by Dr. Barry.

Tetney. [Louth Rural District.]

On September 2nd, a woman aged 71 years, residing at *Tetney* in the Louth Rural Sanitary District (Lincolnshire), who had been suffering from slight diarrhœa for some months, was attacked with symptoms suspicious of cholera. On September 3rd purging was stated to have been persistent, with motions having the appearance of "curds of milk "floating in water." The purging was accompanied by cramps in the legs, coldness of surface, husky voice and great thirst. She was first seen by a medical man at 11 a.m., September 4th, when she was in a state of pronounced collapse; temperature 97° Fahr.; extremities cold; pulse at wrist almost imperceptible; and she died at 4 p.m. on that day. No post-mortem or bacteriological examination was made in this case. Dr. Domenichetti, the Medical Officer of Health, who had had large experience of cholera in India, regarded the case to be true cholera. The patient had not been from home for six months prior to the onset of the choleraic symptoms; but a daughter-in-law, who lived with her, had, it is stated, three weeks previously, nursed a patient at Grimsby suffering from "choleraic diarrhœa." Special precautions in the direction of prompt interment of the corpse, destruction of all clothing, &c., likely to be infected, and disinfection were carried out and no further suspicious case occurred in the district.

Bradford.

On September 3rd an attack suspected to be cholera occurred at *Bradford* (Yorkshire), which proved fatal on September 4th. The facts of the case as supplied by the Medical Officer of Health are as follows:—J. D. W., male, aged 47 years, living in Wakefield Road, Bradford, was attacked with diarrhœa at 5 a.m. on September 3rd. The patient complained of abdominal pain, which persisted until death; there was, however, no vomiting. The diarrhœa became worse, and was accompanied by cramps; the patient finally became collapsed, and died at 1 a.m. on September 4th. No post-mortem examination was made. The Medical Officer of Health found in the patient's house a bucket of mussels, the remainder of a large quantity purchased from a wholesale dealer in Bradford on September 2nd. The dealer from whom the mussels were obtained was unable to state the source of this particular batch, as he stated he had lately received consignments from several places. This stock had become mixed up; some, however, had been received from Grimsby and Cleethorpes. There was no evidence to show that the deceased had eaten any of the mussels prior to his attack. The usual precautions as to disinfection were taken, and no further cases were reported.

Middleton.

On September 4th a woman, aged 64 years, living at the Old Hall Inn, *Middleton* (Lancashire), was attacked with choleraic illness, which proved fatal on September 5th, 14 hours after the onset of the symptoms. A second woman (aged 70 years), who had been in communication with the case noted above, was attacked with similar symptoms on September 6th, and died after 12 hours illness, on September 7th. A third woman (aged 44 years), who had been in attendance on the second patient, was on September 8th seized with choleraic illness, from which she subsequently recovered. In all these cases the clinical history was consistent with that of true cholera. No post-mortem or bacteriological examinations were made with regard to any of the cases.

Dr. Sweeting made inquiry into the circumstances of the outbreak on behalf of the Board, (*see* Appendix A., No. 5, page 119.) It was not found possible to trace any connexion between the first of these cases and any cholera infected person or place. Measures of disinfection were carried out, and no further cases were reported from Middleton in 1893.

Brigg.

On September 5th a person resident at *Brigg* (Lincolnshire), who had been suffering from slight diarrhœa for some days, was attacked with violent purging and vomiting accompanied with cramps in the lower extremities; stools and vomited matter were "rice water" in character; temperature, 96° Fahr.; pulse, 150. Subsequently the bowels were moved every few minutes, and all matters taken in by the mouth were at once rejected. The voice sunk to a hoarse whisper. Finally, the urine was suppressed, and the patient became comatose, dying on September 8th, after three days' illness. No post-mortem examination was made, and some of the discharges from the bowels forwarded to Dr. Klein for bacteriological examination were found to be unsuitable for the purpose.

Westminster.

On September 5th one of the cleaners of the House of Commons, residing at Marsham Street, *Westminster* (London), was attacked with symptoms suspicious of cholera, which proved fatal on September 7th. Dr. Sweeting was instructed to make inquiry as to the circumstances of the case (*see* Appendix A., No. 6, page 123). A piece of the ileum of the deceased, together with some of the "rice-water" dejecta, was sent to Dr. Klein for bacteriological examination (*see* Appendix B., page 177, Material VI.). Dr. Klein reported the results of his examination to be typical of Asiatic cholera.

On September 20th the death of another cleaner of the House of Commons was reported to have taken place under circumstances suspicious of cholera, and Dr. Sweeting was consequently directed to make inquiry respecting it. From his report, however, it appeared that in this case the death had been caused by peritonitis, due to a strangulated intra-abdominal hernia, and that there was no evidence whatever of cholera.

On October 16th the death of a woman residing in Great Peter Street, Westminster, who had not been seen prior to her death by a medical man, was the subject of a coroner's inquest, and in consequence of the evidence of the medical practitioner who had made a post-mortem examination of the body, to the effect that death might have arisen from cholera, the jury expressed a hope that a bacteriological examination would be made. A portion of her ileum was accordingly sent to Dr. Klein by the Medical Officer of Health to the London County Council, and Dr. Klein reported that the piece of ileum "was much congested and "contained brownish blood-stained fluid. No definite commas amongst "crowds of bacteria. Cultivations entirely negative quâ comma-"bacilli." Such clinical history as could be obtained gave no grounds for suspicion of cholera.

Boston.

On September 6th, a female, aged 47 years, resident at *Boston* (Lincolnshire), was attacked by diarrhœa. She was seen by her medical attendant (Mr. W. J. Pilcher) at 5 p.m., when the diarrhœa was slight; at 9.30 p.m. she had violent cramps in the legs and abdomen; "rice water" discharges from the stomach and bowels; blueness of skin and impending collapse. The attack proved fatal about 4 a.m. on September 7th. In view of the symptoms and the rapidly fatal results, Mr. Pilcher, with the concurrence of the Medical Officer of Health, forwarded a portion of the colon and some of the discharges to Dr. Klein for bacteriological examination (*see* Appendix B., page 178, Material IX.). From the results of his examination Dr. Klein reported that the cultivations were typical of Asiatic cholera. No source of infection could be traced. The deceased had come from Manchester to Boston some weeks before her attack, and had not since left the town. She is stated to have been indulging heavily in alcohol prior to her attack.

Ashbourne.

On September 6th the first of a series of fifteen attacks of choleraic illness, of which nine proved fatal, occurred at *Ashbourne* (Derbyshire). This outbreak was investigated by Dr. Bruce Low, whose detailed report will be found in Appendix A., No. 8, page 127. All the attacks occurred in the seven days ending September 12th. A piece of the ileum of one of the fatal cases was sent to Dr. Klein for bacteriological examination (*see* Appendix B., page 180, Material XVIII.). Dr. Klein reported the results of his examination to be indicative of true cholera. The dissemination of the disease was attributed to the use of polluted well water, but the source of the cholera remained, as will be seen from Dr. Low's report, obscure.

Appleton-le-Street.

On September 6th, a man aged 28 years, on his return home to *Appleton-le-Street*, in the Malton Rural Sanitary District (Yorkshire), from Scarborough, was attacked with symptoms of a choleraic nature, and died early on September 10th. Subsequently between September 12th and September 20th four other persons, relatives of deceased, and who had either stayed in the house at Appleton-le-Street or had visited there, were attacked with a similar illness, and of these four persons, two, aged 70 and 27 years respectively, died. A sample of the dejecta and a portion of the ileum of the second and third persons respectively fatally attacked were forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 182, Materials XXXIV. and XXXIII.). Klein reported that as regards the stool, although the microscopical examination gave suspicious results, the cultivations proved negative with respect to the presence of comma-bacilli. The results of the examination of the portion of ileum were, however, typical of true cholera. A sample of one of the stools passed on the fifth day of illness in the case of one of the patients who recovered, was also forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 183, Material XXXVII.). In this case Dr. Klein, on making a microscopical examination, detected the presence of some suspicious looking curved bacilli, but the cultivations all remained sterile, a result probably due to the "disinfection" of the stool prior to its despatch to him. The circumstances of this outbreak were made the subject of a special inquiry by Dr. Copeman on behalf of the Board, and his detailed report will be found in Appendix A., No. 9, page 132.

St. Marylebone.

On September 6th a case notified to be "cholera" occurred in *St. Marylebone* (London). No medical man was called in until about an hour before the patient's death, which took place on September 6th, at about 8 p.m. An inquest was accordingly held, when the following facts were obtained as to the history of the case:—J. E., male, aged 12 years, residing at Elgin House, Horace Street, Marylebone, was stated to have been in good health and to have attended school on September 5th. About midnight he had an attack of vomiting, but slept well until 7 a.m. on September 6th, when he was again seized with vomiting, accompanied by diarrhœa, which persisted throughout the day, and a medical man was called in about 7 p.m., when he found the child in a state of collapse, death taking place about three quarters of an hour afterwards. At the post-mortem examination the stomach was found to be somewhat congested at the great curvature, and to be full of food, chiefly consisting of curdled milk; the intestines generally were stated to have been much congested, and a small portion of the ileum to have been intensely congested. The small intestine contained mucus, tinged with bile, and the large intestine liquid matter also tinged with bile. Portions of the contents of the stomach and intestines were forwarded

to the College of State Medicine for bacteriological examination, but the cultivations were stated to have yielded negative results as regards the presence of comma-bacilli. No history of exposure to infection could be obtained and no further cases were reported.

Willesden.

On September 7th, a man arrived at *Willesden* (Middlesex) from Cleethorpes suffering from diarrhœa, which had commenced whilst at Cleethorpes on September 5th. The history supplied by Dr. Bathis, the medical attendant, is as follows:—M. E., male, aged 60 years, residing in High Street, Harlesden, Willesden, had been attacked on September 5th when at Cleethorpes with diarrhœa. On September 7th he travelled from Cleethorpes to Willesden, *viâ* King's Cross; on September 8th, he had from 15 to 20 motions of the bowels; on September 9th, at 6.45 p.m., he was first seen by Dr. Bathis, and was then suffering from slight diarrhœa, vomiting, and cramps; temperature in mouth, 95·6° Fahr., in axilla, 95° Fahr.; on the morning of September 10th temperature in axilla, 95·8° Fahr.; patient had evacuated bowels three times, and had vomited twice during the night, the cramps still continued slightly, patient much better. Some of the bowel evacuations were sent to Dr. Klein for bacteriological examination (*see* Appendix B., page 179, Material XI.), who reported that his cultivations proved negative as regards the presence of Koch's comma-bacillus.

Doncaster.

On September 7th a person travelling by rail from Leeds to *Doncaster* (Yorkshire) was attacked on his arrival at the latter place with choleraic symptoms and died the same day. The history of the case as supplied by the Medical Officer of Health and the House Surgeon of the Doncaster Infirmary is as follows:—R. P. H., male, aged 45 years, publican, residing at the Abercrombie Inn, Burmantofts, Leeds, travelled on September 7th from Leeds to Doncaster; the patient began to feel ill in the train when only halfway to Doncaster. On arrival at Doncaster Station about noon he complained of great pain in the bowels, and was sick and purged. Under medical advice he was removed to the Doncaster General Infirmary. Upon admission into the Infirmary at 1.30 p.m. he was in a state of extreme collapse; pulse at wrist almost imperceptible; hands, feet, and legs cold, but trunk warm; face cold and dusky, covered with a profuse cold perspiration; eyes sunken; pupils equal, but somewhat contracted; voice scarcely above a whisper; cramps in thighs, calves, feet, and hands; severe abdominal pain. There was no purging after his admission to hospital, and he only vomited once. The patient gradually sank and died at 5.15 p.m. Rigor mortis came on very quickly, commencing within a few minutes after death. A post-mortem examination was made the same evening, when the following conditions were observed:—Intestines fairly distended, filling the abdominal cavity; portions of the bowels had a faint rosy tint on their serous aspect; the contents consisted of a thin, whitish, opaque fluid; lungs shrivelled, dry, and tough; spleen contracted and leathery; heart normal, but contracted and empty; blood dark coloured and thick; other organs apparently normal. A portion of the ileum was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 178, Material VIII.). Dr. Klein reported that although on microscopical examination there was evidence of the presence of comma-shaped organisms, the cultivations all proved sterile, a result evidently due to the fact that spirits had been added to the specimen of bowel.

It appeared that the patient had been ailing for several months prior to his attack. About the end of July he had suffered when at Morecambe from an attack of diarrhœa. Between 9.30 a.m. and 10 a.m.

on September 7th, previous to his leaving Leeds for Doncaster, he went to a fish-shop and ate some oysters, which had come from Cleethorpes. He had not been from Leeds for some time previous to September 7th. The usual precautions as to disinfection were taken at Doncaster, and no further cases were reported.

Morton. [Gainsborough Rural District.]

On September 7th a resident in the village of *Morton*, in the Gainsborough Rural Sanitary District (Lincolnshire), was attacked with choleraic symptoms, which proved fatal on September 8th, after 19 hours' illness. Dr. Bruce Low was instructed to investigate the circumstances of the case, and his detailed report will be found in Appendix A., No. 10, page 136. Portions of the ileum and colon of this person were forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 179, Material X.). Dr. Klein reported the result of his examination to be typical of cholera.

Bethnal Green.

On September 8th a case of reputed cholera occurred at *Bethnal Green* (London), which proved fatal on September 9th. The following is the history so far as could be obtained from local sources:—J.A., female, aged 20 years, residing in Treadway Street, Bethnal Green, on September 7th ate a dozen oysters for supper; on the following day (September 8th) she suffered from slight diarrhœa. On September 9th, at 8 a.m., she was attacked with violent vomiting and purging, accompanied with general cramps "all over her." At 11 a.m. she was stated to have been cold and clammy, and at 5 p.m. to have been in a state of collapse; she died at 10 p.m. There was no history of exposure to infection to be obtained; the deceased had prior to her attack been nursing her mother, who was "out of sorts," but who had not suffered from diarrhœa. No post-mortem or bacteriological examination was made in this case.

Great Yarmouth.

On September 8th, an itinerant watercress seller living at a common lodging-house in *Great Yarmouth* (Norfolk), was attacked with severe diarrhœa and cramps, and was in consequence removed to the Borough Hospital, where he speedily recovered. On September 18th, a female adult living at Yarmouth was seized with choleraic symptoms and died on September 20th. In neither of these cases was any post-mortem or bacteriological examination made. On September 21st, a boy, aged 13 years, was attacked with choleraic illness, which proved fatal the following day, September 22nd. A portion of the ileum of this patient was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 182, Material XXXVI.) Dr. Klein reported the results of his examination to be characteristic of true cholera. On September 28th, a fourth attack of the nature of cholera occurred at Yarmouth in the person of a girl aged 9 years; in this instance a sample of one of the "rice-water stools" was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 183, Material XL.). Dr. Klein reported the stool to be "a pure cultivation of Koch's cholera commas." The child died about eight days after the onset of the disease. The circumstances of these cases at Yarmouth were made the subject of a special inquiry by Dr. Copeman on behalf of the Board, and his detailed report will be found in Appendix A., No. 11, page 140.

Clerkenwell.

On September 8th a person residing in *Clerkenwell* (London) who had been attacked on that day with symptoms suspicious of cholera was admitted to St. Bartholomew's Hospital. The history of the case, as summarised from the hospital records, is as follows:—H. T., male, aged 24 years, printer, living at Chapel Street, Clerkenwell. At 8 a.m.

on September 8th attacked with diarrhœa, at 9.45 began to vomit; at 10 a.m. cramps in the legs commenced, and at 11.45 the cramps extended to the arms; at noon he was admitted to St. Bartholomew's Hospital, his bowels having been opened twelve times in the four hours prior to his admission. Upon admission his condition was one of extreme collapse; eyes sunken; face livid; tongue dry, covered with brown fur; speech husky; mental condition unimpaired; much cyanosis of whole body; pulse 130, almost imperceptible, but apparently regular; temperature 96·2° Fahr. in the axilla, and 100·4° Fahr. in the rectum; respirations 18; the abdomen was retracted, but there was no tenderness, and no dulness in the hypogastric region; extremities cold and cyanosed; frequent cramps, causing severe pain in the upper and lower extremities; no abdominal cramp; stools watery, very light yellow in colour containing no fœcal matter, very offensive; suppression of urine, less than half an ounce having been passed in 24 hours. At 5.35 p.m. patient vomited matter "rice water" in character; at 10.45 p.m. passed "rice-water" stool; urine, three drachms, contained albumen; temperature at 7 p.m. 96·8° Fahr. The patient passed a restless night, but on the morning of September 9th his general condition was much improved; less cyanosis; pulse 92, better volume and tension; bowels opened three times, stools "rice water" in character; urine 13 ounces, contained trace of albumen; no vomiting; temperature, morning, 99·2° Fahr., evening 97·4° Fahr. On September 10th, improvement in general condition continued; bowels opened twice, stools "rice water" in character, but containing a slight amount of fœcal matter; no cyanosis; pulse 80; urine 33 ounces; temperature, morning, 96·4° Fahr., evening 98·8° Fahr. On September 11th patient complained of rheumatic pains in his shoulders; semi-solid stool, light in colour; urine contained trace of albumen; temperature, morning 98·2° Fahr., evening 100° Fahr. September 13th: solid stool, light brown; urine not albuminous September 19th: temperature normal; patient convalescent; he was discharged cured on September 26th. A portion of one of the "rice-water" stools passed on September 9th was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 178, Material VII.). Dr. Klein reported that whilst from the microscopical examination there was some suspicion of the presence of comma-bacilli, cultivations proved negative as to Koch's commas. No evidence could be obtained of the patient having, previous to his attack, had contact with any persons suffering from similar illness. He was stated to be a man of somewhat intemperate habits; on the day, September 7th, prior to his attack he had been at his work, in the evening he had drunk six pints of beer and eaten an egg, a sandwich and some fried plaice, the beer and the fish both being stated to be of doubtful quality.

On September 17th a youth residing also in *Clerkenwell* was attacked with choleraic symptoms, and was admitted the same day to St. Bartholomew's Hospital. The patient was there seen on behalf of the Board by Dr. Copeman, and the following history has been compiled partly from Dr. Copeman's memorandum, partly from the hospital records:—J. E. F., male, aged 11 years, living in Little Sutton Street, Clerkenwell, was apparently quite well until at 4.30 p.m. when leaving church on September 17th he was suddenly seized in the street with pains in the abdomen, vomiting, and diarrhœa, and his legs gave way and he fell down. He was admitted to hospital at 7.45 p.m. On admission he was very collapsed; face pinched and sallow; pulse imperceptible at wrist; eyes sunken; voice a mere whisper; much thirst; vomiting a quantity of watery material, which on standing deposited a flocculent

sediment; bowels opened immediately after admission; motion watery, opalescent, with slight pink tinge; no cramps; urine suppressed; temperature 99·6° Fahr. He vomited several times during the night and passed watery motions in bed. On September 18th urine still suppressed, bladder not distended; abdomen retracted; general condition of patient improved; pulse still small but regular; vomiting ceased; in evening bowels opened, motion watery, opalescent with flocculent sediment; temperature, morning, 97·8° Fahr., evening 97·8° Fahr. On September 19th the patient passed urine for the first time 30 hours after admission; the general improvement in his condition was maintained, and the patient gradually recovered and was discharged cured on September 27th. His temperature remained subnormal until he left the hospital. Samples of the stools passed by the patient on September 17th and 18th were forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 181. Material XXVI.). Dr Klein reported the results of his examination to be negative as regarded the presence of comma-bacilli. As regards the history of this patient prior to attack, it appears that whilst on September 17th his dinner consisted of three or four ginger nuts and an orange, he had on the evening of September 16th, together with his brother, eaten some fried fish and potatoes, obtained ready cooked at a shop in Goswell Road. This fish was stated to have been obtained from Grimsby. After eating the fish the brother of the patient was attacked with vomiting, but recovered.

On September 19th another boy residing in the same block of houses in *Clerkenwell*, as the case of J. E. F. referred to above, was attacked with symptoms somewhat suspicious of cholera, and was admitted into St. Bartholomew's Hospital. The history of the case, as obtained from notes supplied by the Medical Officer of Health of the London County Council, and from the hospital records, is as follows:—S. F., male, aged 6½ years, living in Little Sutton Street, Clerkenwell, was attacked at 8.30 p.m. on September 19th, with vomiting and purging, the motions being very profuse and watery. He was admitted to hospital about 11.30 the same evening, and was purged and vomited in the surgery. On admission to the wards the vomiting persisted; the material brought up consisted of mucus with a little frothy secretion, and was on one or two occasions streaked with blood; purging occurred immediately after admission; motions very loose, but somewhat darker in colour than those passed in the surgery; urine suppressed; temperature, 99° Fahr.; pulse feeble; face pinched. On September 20th the diarrhœa ceased, and the patient began steadily to improve; temperature, morning, 96·6° Fahr., evening, 97° Fahr. On September 21st the patient passed urine (11 ounces) for the first time since his admission to hospital. He was discharged cured on September 27th. His temperature remained sub-normal until he left. No bacteriological examination was made in this case. With regard to the history of the patient prior to attack, it is interesting to note that on September 18th he had eaten some fried plaice obtained from the same shop in Goswell Road as that referred to in the case of J. E. F. noted above. This shop had a notice in the window "Fresh fish from Grimsby daily."

The only other case of illness occurring in the Clerkenwell district during 1893 in which there was any suspicion of cholera was that of a girl residing at Merlin Place, who died on October 23rd, after having suffered from symptoms which were by no means free from doubt. Upon post-mortem examination, however, it was apparent that the patient had died from peritonitis, and not from cholera. The following notes on

this case were supplied by the Medical Officer of Health of the London County Council :—

"E. O., female, aged 14 years, book folder, Merlins Place, Clerkenwell. October 20th, pain in abdomen and shivering came on, followed by frequent vomiting. On 21st the vomiting continued, and was accompanied by diarrhœa. Motions light-coloured. On the 22nd, delirious, still vomiting. On 23rd, patient was admitted into St. Bartholomew's Hospital. Patient was then collapsed, with cold extremities. Died same night. A post-mortem examination was made, and there was found to be intense purulent peritonitis. There was no lesion visible to the naked eye to account for this. A portion of the ileum and of the peritoneal fluid was given to Dr. Klein. Report by Dr. Klein :—In the peritoneal turbid fluid, and in the solid masses of lymph, numerous cocci—in clumps, and as diplo-cocci—could be distinguished. The whole of the intestine was congested, and in its cavity solid lumps of lymph containing the same masses of cocci. No comma-bacilli could be found. Cultivations proved negative quâ comma-bacilli."

Mansfield.

On September 8th a woman, aged 46 years, living in Stockwellgate, *Mansfield* (Nottinghamshire), was seized with symptoms stated to have been choleraic in character, accompanied with suppression of urine, and followed by collapse, death occurring 96 hours after seizure. The patient's medical attendant, who is said to have had experience of cholera abroad, regarded the case as one of undoubted Asiatic cholera. A sample of a stool passed on September 12th, was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 180., Material XX.). Dr. Klein reported the appearance of some suspicious comma-shaped bacilli on microscopical examination, but the results of his cultivations were negative as regards the presence of Koch's commas. Two cultures of material made on the spot by Mr. C. Wills, the Medical Officer of Health, and forwarded to Dr. Klein, were found to consist entirely of bacillus coli. The patient, who was the wife of a greengrocer in Mansfield, is stated to have been very fond of oysters, of which she obtained a quantity on September 4th, four days before the commencement of her illness. All necessary precautions as to disinfection, &c., were taken, and no further cases were reported from the district.

Great Clacton.

On September 9th, about midnight, T. P., female, aged 6 years, residing at "The Flowers Mission Home," *Great Clacton* (Essex), was attacked with diarrhœa and vomiting. At 7.30 on the morning of September 10th a medical man was called in and found T. P. suffering from purging, ("rice-water" stools), and vomiting, urine suppressed, cramps, collapse, with sunken features, pulseless, and blue. At 9.40 a.m. the case proved fatal. No post-mortem examination was made in this case. On September 11th, Dr. Cook, the Medical Officer of Health for the district, reported that the matron of the Home and nine other children had been attacked with purging and vomiting, and in the case of one of these (K. W., female, 10 years of age), where the stools were "rice-water" in character, a sample was sent to Dr. Klein for bacteriological examination (*see* Appendix B., page 179, Material XVI.). As a result of his examination Dr. Klein reported that the cultivations had proved negative as regards the presence of Koch's comma-bacillus. These cases all recovered; there was no further spread of the disease.

Leicester.

On September 9th a case of suspected cholera at Humberstone Gate, *Leicester* (Leicestershire), was notified to Dr. Priestley, Medical Officer of Health for that Borough. The history of the case as reported by Dr. Priestley is as follows :—H. A., female, aged 74 years, was attacked with diarrhœa and vomiting at 4 a.m. on September 9th. On examina-

tion by the Medical Officer of Health the patient was found to be violently sick and purged, passing principally a watery, flaky fluid. She was pulseless and her hands and feet were shrunken and blue. There was suppression of urine; a husky, weak, whispering voice; whilst the temperature of the body was 94·6° Fahr. There were cramps in the arms and legs, and pain at the pit of the stomach, but no generally diffused abdominal pains. The brain was unaffected, the intellect being perfectly clear. H. C. died at 2 p.m. on September 10th, never having rallied from the state of collapse. A post-mortem examination was made the same evening, with the result that the organs of the body were all healthy and free from any signs of congestion, with the exception of the ileum and about one inch of the cæcum, next to the ilio-cæcal valve, in which positions there was distinct, well-marked congestion. A portion of the ileum was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 179, Material XII.). He reported the results of both the microscopical examination and of the cultivations to be positively indicative of true cholera. The patient had been subject to attacks of diarrhœa from time to time during recent years. For some weeks prior to her attack she had not been out of Leicester; but from the investigations of Dr. Priestley it appeared that she lived at an oyster shop, where a consignment of oysters from Cleethorpes had been received on September 8th. These oysters had been sent in their "native state," *i.e.*, covered with black, slimy mud. No distinct history could be obtained of the deceased having eaten any of these oysters, nor of her having come into contact with them in the way of washing them, &c.; but the statements made at the time were not regarded by the Medical Officer of Health as satisfactory.

Ilkeston.

On September 9th a male, aged 20 years, residing at *Ilkeston* (Derbyshire), who was convalescing from an attack of enteric fever, was suddenly attacked with vomiting and diarrhœa, which persisted until September 17th, when he died. The day following the man's death, one of his sisters, aged 20 years, was attacked with symptoms strongly suspicious of cholera, and on September 19th, a second sister, aged 17 years, who had suffered from a slight attack of diarrhœa on September 15th, also developed symptoms of a choleraic nature. The sister first attacked died on September 19th, and a portion of her ileum was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 182, Material XXX.). Dr. Klein reported the results of his examination to be typical of cholera. On September 14th, a night-soil man, aged 56 years, employed at Ilkeston, was seized with symptoms typical of cholera and died the following day. An inquiry was made by Dr. Wheaton into the circumstances of the cases noted above, and his detailed report will be found in Appendix A., No. 12, page 145. The source of infection was not ascertained. No further cases were reported.

Handsworth.

On September 9th an attack, suspected to be cholera, occurred at *Handsworth* (Yorkshire), which proved fatal on September 11th. The facts of the case supplied by Dr. Scott, the Medical Officer of Health, were as follows:—G. K., male, aged 57 years, butcher, residing at Hollinsend, Handsworth, was attacked on September 9th with sickness and diarrhœa. He was seen by Dr. Scott in the evening and was then found to be suffering from severe vomiting and purging, accompanied with cramps of the muscles of the abdomen, thighs, calves of the legs, toes, forearms, and fingers. There was constant thirst, as well as great depression and restlessness. The stools were very frequent and "rice water" in character; pulse feeble and rapid; temperature normal. The

purging and vomiting continued throughout the night, and on the morning of September 10th his condition was reported as follows:—Expression still more anxious and pinched than on previous evening; face livid; eyes sunken; extremities cold; temperature 95° Fahr.; pulse very feeble and rapid; the skin, especially of the extremities, cyanosed; vomiting and purging persistent; the vomited matters watery in character and containing whitish shreds; cramps well marked in the calves and toes, the muscles of the calves being drawn up into knots and the toes extended; consciousness maintained. By the evening the patient was stated to have passed into a state of profound collapse, and death took place at 4 a.m. on September 11th. A post-mortem examination was made at 11.30 a.m. the same day, with the following results:—Body still warm; rigor mortis well marked; skin of mottled appearance and livid in dependent parts. Heart: left side almost empty, right side nearly full of thick dark-looking blood, not coagulated. Lungs contracted, containing but little air, slight hypostatic congestion. Liver and kidneys pale. Spleen very much contracted. Stomach contained a considerable quantity of gruel-like fluid; mucous membrane showed patches of congestion and had a sodden appearance. Small intestines distended and containing a quantity of fluid similar to that found in the stomach, though more liquid, and having a larger number of whitish shreds; the mucous membrane showed patches of congestion, especially towards the cæcum. Large intestine distended, containing only small quantity of liquid. Bladder empty. A portion of the ileum was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 179, Material XIII.). Dr. Klein reported that cultivations yielded positive results as regards the presence of Koch's comma-bacilli. The movements of the deceased prior to his attack could not be definitely ascertained. It was, however, his custom to go to the neighbouring towns of Sheffield and Rotherham to buy meat for sale, and it is to be noted that a fatal case of cholera had occurred at Rotherham prior to his illness. No further cases were reported from this district.

Fulham.

On September 10th a female inmate (aged 51 years) of the *Fulham* Union Workhouse (London) was attacked with choleraic illness, which proved fatal the following day (September 11th). A portion of the ileum of this patient was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 179, Material XV.). Dr. Klein reported the results of his microscopic and bacteriological examinations to be indicative of true cholera. Dr. Copeman made inquiry into the circumstances of this case on behalf of the Board, and his detailed report will be found at Appendix A., No. 13, page 148. It was not found possible to trace any connexion between this case and any cholera infected person or place. Measures of disinfection were carried out, and no further cases were reported.

South Shields.

On September 10th a person living at *South Shields* (Durham), who had been suffering from slight diarrhœa for some days previously, was suddenly attacked with vomiting, purging, and cramps. The history of the case, as supplied by Dr. Turnbull, the Medical Officer of Health, is as follows:—A. W., male, aged 56 years, watchmaker, unmarried, living at South Shields, had for about three weeks prior to September 10th been drinking heavily. He went to bed at an unusually early hour on the evening of September 9th, complaining of indisposition, and was seized with diarrhœa and vomiting about 1 a.m. on September 10th. He was first seen by a medical man about 3 p.m. on that day,

and at that time he was suffering from severe purging and vomiting; the stools, of which he passed several during the time the doctor was in the room, were watery and copious, with white flocculent matter suspended in them (typical "rice water" in character); vomited matter watery and copious; cramps in abdomen and legs very severe, less severe in the arms and rest of the body; temperature, 96° Fahr.; pulse quite imperceptible at the wrist; acute abdominal pain, worse at intervals; voice, a husky whisper, and requiring great effort in its production; face pinched; eyes sunken, with dark areolæ; hands and feet cold; skin dry, wrinkled, and livid; urine suppressed; intense thirst; respiration slow and feeble; breath and tongue cold; patient in a state of collapse. During the next two days, September 11th and 12th, the patient rallied somewhat, the diarrhœa and vomiting gradually ceased, and the cramps and abdominal pain disappeared. The temperature rose to normal, the pulse became perceptible again and improved in character, and the patient was rapidly progressing towards convalescence, when on September 14th delirium tremens supervened and he died on September 15th from cardiac failure. No post-mortem examination was made. A sample of one of the stools passed on September 11th was forwarded to Dr. George Murray, Professor of Comparative Pathology, and Lecturer on Bacteriology, University of Durham College of Medicine, for bacteriological examination. Dr. Murray, after making a microscopical examination, together with peptone and plate cultures, reported that the case was indistinguishable from true cholera. For two or three weeks previous to his illness the patient had been drinking heavily in the lowest quarters of South Shields, but had not been outside the town. No definite information respecting his movements about the town could be obtained. Whilst drinking he was stated to have eaten voraciously any kind of food. Fragments of tomatoes were contained in the first stools and vomited matter. The sanitary circumstances of his lodgings were good. The following precautions were taken:—The patient was removed to the Infectious Diseases Hospital; the house where he had lived was disinfected; all food stuff destroyed, all bedding, carpets, and clothing burnt, walls stripped, ceilings whitewashed, and the whole place thoroughly cleansed. The yard and drains were sluiced with strong solution of perchloride of mercury, as also were the drains, &c. of all the premises which the patient was found to have visited. Burial took place five hours after death, the body was closely wrapped in sheets saturated with carbolic acid solution, and the coffin packed with a "disinfectant" powder.

On October 1st a second person in another part of the town was seized with choleraic illness, which proved fatal the next day. The following history has been supplied by Dr. Turnbull:—W. F., male, aged 46 years, plater in a ship-yard, married, living at South Shields, was suddenly seized with vomiting and purging early in the morning of October 1st. The patient stated that he had been perfectly well prior to his attack. He had drunk several glasses of beer on the night of September 30th. He was first seen by his medical attendant at noon on October 1st. Dr. Turnball saw him at 3 p.m., when his condition was as follows:—Incessant diarrhœa and vomiting; stools watery, copious, with a greyish white deposit of flocculent and granular débris; the vomited matters copious and watery; cramps in the legs and abdomen, and to a less extent throughout the rest of the body; temperature 97° Fahr.; pulse imperceptible at the wrist; heart-sounds heard with difficulty, very slow (28) and soft; great abdominal pain, relieved by pressure; voice a husky whisper, produced with difficulty; expression

as of intense pain; face livid; eyes sunk; skin dry and cold; skin of feet and hands cold and dry; urine entirely suppressed; intense thirst; respiration slow, shallow, and laboured; condition of extreme collapse. The patient died at 1.30 p.m. on October 2nd. No post-mortem examination was made. A sample of one of the "rice-water" stools passed on October 1st was submitted to Dr. George Murray for bacteriological examination. Dr. Murray reported that from the results of his examination the case was in his opinion true cholera. This patient, prior to his illness, had not been outside South Shields for some months. He was not acquainted with the first case described above, and had never been in his company. No history could be obtained of his having taken improper food, or of his being exposed to insanitary conditions. The same precautions as those detailed above were taken. No further cases of suspicious illness were reported from South Shields in 1893.

East Retford.

On September 10th a man residing at *East Retford* (Nottinghamshire), was seized with choleraic illness which proved fatal in less than 16 hours. The history of the case as supplied by Mr. Walter Spencer, the Medical Officer of Health, is as follows:—W. G., male, aged 50 years, publican and bookmaker, residing at the Half Moon Inn, Market Square, Retford, attended Doncaster races on September 5th, 6th, 7th, and 8th during which period he was suffering from slight diarrhœa. On September 10th, although not feeling well, he attended to customers as usual on the premises of the Half Moon Inn up to 3 p.m. when he went to lie down for rest. At 4 p.m. he was seized with violent cramping pains in the arms and legs, accompanied by severe vomiting and diarrhœa. In consequence of these symptoms a medical man was called in, who observed in addition that the voice was a mere whisper, that the patient was very restless, and complained of great depression, that the evacuations were "rice water" in character, and that there was suppression of urine. The patient became rapidly worse and passed into collapse; extremities became cold and the surface of the body livid, and the face shrunken. Death occurred at 7.30 a.m. on September 11th, fifteen and a half hours after the onset of the illness. A post-mortem examination was made half an hour after death, when rigor mortis was very marked, temperature of surface 98·4° Fahr. Upon opening the abdomen the peritoneal surface of the bowels was observed to be congested, but no other abnormal condition was noticed. A portion of the ileum was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 179, Material XIV.). Dr. Klein reported the results of both the miscroscopical and bacteriological examinations to be indicative of true cholera.

Owing to the patient's occupation (bookmaker) it was not possible to exclude in this instance antecedent relation with cholera; but so far as the facts went no such relation was traceable, complete precautions as regards disinfection, were taken, and no further cases were reported from the district.

Mitcham.

On September 11th, a case of suspected cholera, which proved fatal on September 14th, occurred at *Mitcham*, in the Croydon Rural Sanitary District, (Surrey). The following is a summary of the history of the case, as reported by Dr. Darra Mair, the Medical Officer of Health:—H. B., male, aged 53 years, a resident at Mitcham, and employed at a local cornfactor's, was attacked at 10.30 p.m., on September 11th, with rather severe diarrhœa, which continued throughout the night and also during the next day (September 12th), although its severity was not sufficient to prevent his partially attending to his work. On returning home in

the evening he first complained of the diarrhœa to his friends, and feeling worse went immediately to bed (about 7 p.m.). Although he had taken some diarrhœa mixture, the diarrhœa now became very much intensified and was accompanied by severe cramps. A medical man was sent for at 10.30 p.m. The medical attendant reported that when he saw H. B. the cramps were very severe, affecting chiefly his arms and legs; that his expression was anxious, but that there was no cyanosis, pulse 120, feeble; temperature in the axilla, 97° Fahr.; tongue moist and coated with whitish fur. Also he reported that the patient complained much of thirst. No pain was experienced on pressing the abdomen. The general condition was one of moderate collapse. On September 13th the patient was seen by the Medical Officer of Health, at 1.45 p.m., his condition at that time was reported to be one of general collapse; he was very drowsy, much cyanosed about the legs, feet, and hands,—the skin of the latter being much puckered. His face was very pinched, expression indicated great pain, but there was no marked cyanosis, the lips only being a little dusky. The pulse was 120; the tongue was coated with thick brown fur, but was moist; temperature 97° Fahr.; very little, if any, urine had been passed since 10.30 the previous night; but the diarrhœa had abated considerably, and there had been no vomiting since 5 a.m. The cramps still continued. No motion had been saved; but some liquid was squeezed out of some sheets which had been placed beneath the patient, and this liquid, which had the appearance of dirty milk and water, was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 180, Material XIX.). Dr. Klein reported the detection of comma-shaped bacilli under microscopical examination—cultivations, however, proved negative as regards Koch's commas. H. B. was last seen by the medical attendant at 9 p.m., on September 13th, when his condition was reported as follows:—Temperature, 102·4° Fahr.; pulse 120, exceedingly feeble; respirations 28; tongue moister and cleaner; motion passed at 8 p.m., 1½ ounces of creamy consistency, much bile stained, chocolate colour, and contained many epithelial scales and blood corpuscles; very little urine voided; hands cold and rather blue; feet and legs warm and much less blue than in the afternoon; voice quite hoarse; cramps less frequent and less severe; no vomiting; still great thirst; face pinched, but not blue. Death took place at 2.30 a.m. on September 14th. At the post-mortem examination which was made on September 14th, the abdomen only was examined, the intestines were distended, pressed against the abdominal wall, and showed much injection of the capillaries. The right kidney was examined, the cortical portion was rather wasted; the medullary portion was apparently healthy; the capsule peeled easily, except one spot. The gall bladder contained about half an ounce of bile. The urinary bladder was quite empty. About one foot of the lower ileum was tied *in situ*, removed, and sealed up in a bottle, and forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 180, Material XXI.), who reported the detection of comma-shaped bacilli by microscopical examination, but the absence of true cholera bacilli in the cultivations. As to the previous history of the patient, it appears that he had not been away from Mitcham for many weeks, except to Tooting for a walk on September 10th, with other members of his family. He and his family dined off roast pork on that day, all of them (five) partaking of it, and this pork was also eaten cold on the next day. None of the other members of the family were taken ill in any way. He admitted having drunk water from a pump in the yard in which he worked, though he had been told it was only fit for cattle. The only other clue that was found was that the patient had

been engaged, on September 9th, with several other men, in receiving a consignment of Russian oats that had just arrived from St. Petersburg. On inquiry, however, it was found that the oats had arrived in bulk, and were unloaded at the docks in London into sacks belonging to the employer of the patient, and that the patient merely carried the sacks on his back from the carts to the store at Mitcham. Moreover, his fellow workmen had been free from the disease, mild or otherwise. The usual precautions as to disinfection were taken, and no further cases were reported.

Lambeth.

On September 11th, T. E. (male), aged 61 years, residing at Kennington Road, *Lambeth* (London), was attacked with purging, vomiting, and cramps, the evacuations being described as "rice water" in character. From information furnished by the Medical Officer of Health of the London County Council, it appeared that T. E. had been to Ramsgate with his three daughters, from September 2nd to the 4th; he returned to London on September 4th. On the two following days (September 5th and 6th) he suffered from slight diarrhœa, which, however, did not continue after September 6th. From the latter date, although somewhat unwell, he remained free from diarrhœa until September 11th, when he was attacked early in the morning, as noted above. By 6 o'clock p.m. he had become so prostrated that some eight pints of saline fluid were injected into his veins. He revived for a short time, but died at 5.40 a.m. on September 12th. The results of the post-mortem examination made on September 12th were not such as would enable distinction to be made between English and Asiatic cholera. A portion of the ileum was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 180, Material, XVII.), who reported the results of the culture experiments to be positively indicative of true cholera. No connexion with any previous case of cholera was traced. The patient was stated to have been exceptionally careful in his diet, and was not known to have taken any article of food not shared by the rest of the family, all of whom, with the exception of one of the daughters, who was reported to have suffered from slight diarrhœa on September 6th, remained well. His movements were limited, as far as is known, to going between his home and his place of business in Little Canterbury Place, Lambeth. He is stated to have always drunk boiled water.

Manchester.

On September 11th, a man, aged 60 years, living in Horner Street, *Manchester* (Lancashire), was seized with purging, vomiting, and cramps, followed by collapse from which he subsequently recovered. The patient had returned home on September 10th from Grimsby, where he had been staying for five days. On September 14th the wife of the patient referred to above, a woman aged 53 years, was attacked with choleraic symptoms; she was first seen by a medical man on the morning of September 15th, when she was found to be suffering from vomiting, purging, and cramps; the stools are stated to have been flaky and colourless. In the evening of the same day she was in a condition of collapse, cyanosed and cold. She could not speak, but merely muttered indistinctly. Death took place at 8 p.m., less than 24 hours after the onset of the disease. A portion of the ileum of this patient, together with a sample of the dejecta, was forwarded to Dr. Sheridan Delépine, Professor of Pathology in the Victoria University, for bacteriological examination. Dr. Delépine reported that "the stools were quite fluid, "watery with greyish flakes suspended in the fluid, very fœtid, curved "bacilli were observed in the epithelial masses, but not grouped in any "typical fashion. After cultivation, spirilla of Asiatic cholera were "isolated and yielded positive results with the usual tests."

On September 14th two women living in Kay Street, West Gorton, *Manchester*, were admitted to the Withington Union Hospital suffering from choleraic illness. The following history of the cases has been compiled from information obtained from local sources:—M. C., female, aged 44 years, married, was admitted to hospital on September 14th, suffering from purging, vomiting, and cramps. On admission the patient was in a state of collapse; face pinched, with dark rings round the eyes; skin cold; pulseless; temperature subnormal; great thirst; purging, stools very loose, dark coloured, passed involuntarily. The patient never rallied, and died on September 15th. About 24 hours after death the abdomen was opened, and a portion of the ileum removed; this was sent to Professor Delépine for bacteriological examination. Professor Delépine reported that the contents of the ileum consisted "of very thick mucus stained with biliverdine. "Walls slightly congested. No swelling of either Peyer's or solitary "glands. A large number of bacteria present among the flakes of "desquamating epithelium; among the bacteria a few comma-shaped "bacilli, not grouped in any typical fashion. After cultivation in "peptone solution and in gelatine, typical characters of cholera spirillum "obtained."

The second case was that of M. M., female, aged 73 years, mother-in-law to the patient referred to above, who was admitted to the hospital in consequence of the development of choleraic symptoms. In this case the purging and cramps were unaccompanied by vomiting. Stools in the first instance dark coloured, and afterwards pale and yellowish, with a very offensive odour; abdominal pain and cramps; voice weak; face pinched, with anxious expression; temperature subnormal; mind clear; urine not suppressed; considerable thirst; pulse very weak and slow. On the following day, September 15th, the condition of the patient was much improved, and she slowly recovered. A sample of the dejecta from this patient was sent to Professor Delépine for bacteriological examination, and he reported as follows:—"Fæces of M. M. received at "1 p.m. on 16th September; very fœtid, pale, yellow, semi-fluid; epi-"thelial flakes present. A large quantity of micro-organisms. After "cultivation, spirilla of Asiatic cholera found." Both patients had prior to the accession of choleraic symptoms been suffering for some days from diarrhœa. The two women occupied the same bed. Although no definite history of exposure to infection was to be obtained, it was ascertained that prior to their attack the patients had eaten freely of oysters which had come from Grimsby. The usual precautions as to disinfection were taken, and no further cases were reported to have occurred at Manchester in 1893.

Hurst.

On September 12th a case of reputed cholera occurred at *Hurst* (Lancashire) in the person of a man who had been to Cleethorpes on September 7th for the day. From local information it appears that the patient made no complaint of feeling unwell until 11 p.m. on September 12th, when the usual symptoms of choleraic diarrhœa set in, followed by collapse, death taking place at 5.30 p.m. on September 13th.

In view of the antecedents of this case it was not considered necessary for a post-mortem examination to be made. Precautions as to disinfection were taken, and no further cases were reported.

London Port.

On September 13th, a Thames lighterman, employed on the barge "Memory" was attacked, when at work on the barge below London Bridge, in the *London Port* Sanitary District, with symptoms suspicious of cholera. Upon the barge reaching Blackfriars Bridge he was

removed to St. Bartholomew's Hospital, where he ultimately recovered. The following history of the case is taken from the hospital records:— W. N., male, aged 20 years, lighterman residing at Park Street, Poplar, left home on September 6th, and was engaged on the barge "Memory" at Purfleet from that date until September 12th, dredging sand. This barge left Purfleet on September 12th, reached Millwall at 10 a.m., and London Bridge at 12.30 p.m. on September 13th. When passing London Bridge, W.N. was seized with griping pains in the abdomen; he got rapidly worse, and diarrhœa and vomiting commenced. The patient became so ill that he had to be taken off his barge at Blackfriars Bridge and removed to the hospital. The motions were described as having been very loose, light yellow in colour, with suspended white flakes. On admission into hospital, at 5.45 p.m., the patient was much collapsed, and evidently in much pain; face livid and shrunken; eyes sunken and half closed, pupils dilated; conjunctivæ slightly injected; voice weak and slightly hoarse; tongue brown, dry, and furred, not cold; sordes on lips; pulse 108, scarcely perceptible at wrist; temperature, 97·4° Fahr. in axilla; skin ashy grey, and moist; abdomen, very much retracted, recti prominent; pain and tenderness in epigastric region; fingers and toes cold, but not shrivelled; severe cramps in the soles of the feet; much thirst; no urine passed since 9 a.m. At 6.18 p.m slight cramps in calves; for two and a half minutes pupils alternately kept contracting and dilating equally on both sides, no cramps elsewhere during this period. At 6.25 cramps in the abdomen. At 8.30 temperature 97·2° Fahr.; pulse, 100; cramps in calves, feet, and abdomen, in the order named. At 8.40 patient much more collapsed, pulse scarcely perceptible; vomited clear, watery fluid. The patient continued to have severe cramps for about 24 hours; at first he had some troublesome vomiting, but after about five hours this ceased; he had no diarrhœa after admission to the hospital, his bowels acted for the first time the sixth day after admission; his urine was suppressed for 48 hours, and the first specimen, which was passed at 8.35 a.m. on September 15th, contained about one-sixth albumen. On September 14th, the patient showed considerable signs of improvement, his temperature remained subnormal, he had no relapse, and was discharged cured on September 23rd. No bacteriological examination was made in this case. No evidence could be obtained of this patient having been in contact with infection prior to his illness, or to his having eaten anything calculated to disagree with him. There was, however, strong suspicion that he had drunk Thames water, although specially cautioned by his father not to do so. The barge was disinfected under instructions from Dr. Collingridge, the Port Medical Officer of Health, and no further cases occurred on board.

Accrington.

On September 13th, a person residing at *Accrington* (Lancashire), was suddenly attacked by symptoms highly suspicious of cholera, which proved fatal the same day. The history of the case furnished by Mr. Thomas J. Monaghan, the Medical Officer of Health, is as follows:— A.M., female, aged 53 years, housewife, living in Stanley Street, Accrington, was attacked at 2.30 a.m., on September 13th, with persistent vomiting and diarrhœa, followed by cramps of the extremities and rapid collapse, death occurring at 9.30 p.m. No error or indiscretion of diet could be ascertained that would have accounted for the symptoms. The deceased had not been away from home for a considerable time prior to her illness. The death was certified to be due to "choleraic diarrhœa," but no post-mortem examination was made. The usual steps as to disinfection, are said to have been taken. On September

14th, another suspicious case of a choleraic nature was reported to have occurred at Accrington, of which the following is the history as supplied by Mr. Monaghan:—W.S., male, aged 75 years, commercial traveller, residing in Pearl Street, Accrington, who had been suffering from diarrhœa since the beginning of September, although not so severely as to prevent his following his usual occupation, became suddenly worse on September 14th, when he called in a medical man, who found him to be suffering from purging, griping, faintness, and cramps. He was perspiring freely, his skin was puckered, pulse 120, small and weak, temperature in mouth, 97° Fahr., face pinched, pupils contracted almost to pin's point, tongue and lips cold and shrivelled, surface of skin cold, voice tremulous, squeaking, and cracked. On September 15th the patient had a very copious liquid evacuation at 3 a.m., a sample of which was preserved for bacteriological examination. At 6 a.m. the symptoms increased in severity pulse became imperceptible at the wrist, temperature 96° Fahr. At 10 a.m. patient in state of collapse, and saline solution injected into veins; at 11.30 a.m. death took place. The sample of stool referred to above was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 181, Material XXVII.). Dr. Klein reported the result of his examination to be typical of true cholera. The source of infection could not be traced. The deceased had, in the course of his occupation, visited Manchester, Stockport, Whaleybridge, Rochdale, and other towns during the fortnight preceding September 14th. The usual precautions as to disinfection were taken, and no further suspicious cases were reported from Accrington during the year.

Croydon.

On September 13th, a person living at *Croydon* (Surrey), who had been suffering from slight diarrhœa for two or three days, was suddenly attacked with choleraic symptoms and died the following day. The history of the case, furnished by Dr. Wilde, the Acting Medical Officer of Health, is as follows:—J. K., male, aged 60 years, resident at Upper Grove, South Norwood, Croydon, was attacked on September 10th by slight diarrhœa, which persisted until September 13th, when there was sudden aggravation of the diarrhœa, which became choleraic in character and was accompanied by severe cramps, blueness of skin, suppression of urine, and collapse; death occurring on September 14th at 1 p.m. A post-mortem examination was made on September 15th, when the condition of the abdominal organs was found to be as follows:—Omentum excessively fat and adherent to the parietal peritoneum; stomach,—empty, mucous membrane covered with ropy mucus and presented patches of slate grey pigmentation here and there. Small intestine,—lower portion of ileum,—showed slight injection of some of the valvulæ conniventes, Peyer's patches and agminate glands sodden in appearance, neither prominent nor excavated. The sigmoid flexure of the rectum presented more acute congestion, there being large irregular patches of deep red injection. Intestinal contents fœculent and grumous; liver adherent to diaphragm, substance pale and firm; kidneys and other organs healthy; bladder empty. A portion of the ileum and some of the bowel discharges were forwarded to Dr. Klein for bacteriological examination, as a result of which he reported the case to be distinctive of true cholera (*see* Appendix B., page 180, Material XXII.) The patient had resided in Croydon for twelve months prior to attack. No evidence could be obtained of his having been either in any infected district or in contact with any infected person, article, or food. There had further been no previous diarrhœa in the neighbourhood, except in the case of a child of the deceased, aged 4 years, who had suffered from a slight

attack of diarrhœa lasting three days, a fortnight before J. K. was attacked. No further cases were reported from this district.

Owston Ferry. [Gainsborough Rural Sanitary District.]

On September 13th, a woman, aged 58 years, living at *Owston Ferry*, in the Gainsborough Rural Sanitary District (Lincolnshire), was attacked with choleraic illness, which proved fatal on September 14th, about 20 hours after its onset. This patient is stated to have suffered from slight diarrhœa for some days prior to September 13th, but this diarrhœa had abated about 24 hours before the choleraic attack took place. Dr. Bruce Low made inquiry with respect to the circumstances of the case, and his report will be found in Appendix A., No. 10, page 137. No bacteriological or post-mortem examination was made. No definite connexion between the patient attacked and previous cholera could be traced, but there was apparently intimate and frequent intercommunication between Owston Ferry and Hull.

Newington.

On September 14th, a woman, residing in Tabard Street, *Newington* (London), was attacked with symptoms suspicious of cholera, and which proved fatal on September 18th. The history of the case, supplied by Dr. Millsom, the Medical Officer of Health, is as follows:—S. B., female, aged 53 years, was seized on September 14th at 2 a.m. with violent purging, accompanied by cramps in the stomach. She had suffered from slight diarrhœa for a week before the severe symptoms supervened. The diarrhœa, accompanied by vomiting, persisted throughout the day; the stools are stated to have been watery in character, the face pallid, eyes sunken, and extremities blue in colour, cold, and clammy. At 2 p.m. she was in a complete state of collapse; the pulse became almost imperceptible. At 8 p.m. some reaction took place, and the vomiting and purging diminished. On September 15th there was some improvement in the condition of the patient, and this improvement was maintained during the following day (September 16th). On September 17th there was a slight relapse, and on September 18th diarrhœa set in again in a violent manner, and the patient relapsed into a state of collapse, from which she never rallied, but died at midnight, September 18th–19th. At 1 p.m., on September 19th, a post-mortem examination was made by Dr. Millsom with the following results:—The small intestine was injected throughout its whole extent, but not to an exaggerated degree. Peyer's glands were not unduly distinct. The right ventricle and right auricle were full of fluid blood. The organs of the body were all fairly healthy, and the body in a well-nourished condition. A portion of the ileum was sent to Dr. Klein for bacteriological examination (*see* Appendix B., page 181, Material XXVIII.). Dr. Klein reported the results of his examination to be negative as regards Koch's comma-bacilli. The deceased was stated not to have been out of the district for some time prior to her illness, except on September 8th, when she went with a friend to Greenwich and there bought some shrimps; she, however, is said only to have eaten a few, as the taste was disagreeable. She had eaten freely of pears with the peel on, and had also taken more tomatoes than usual before her attack. The usual precautions were taken, and no further cases were reported to have occurred in the district during 1893.

Derby.

On September 14th, a case suspected to be cholera occurred at *Derby* (Derbyshire), which proved fatal the same day. The history of the case as supplied by Dr. Iliffe, the Medical Officer of Health, is as follows:—C. N., female, aged 53 years, residing at "The Dun Cow," Bold Lane, Derby, had been quite well until 1.30 a.m., on September 14th, when she was attacked with diarrhœa, but this was said not to have become severe

until 9 a.m., about which time persistent vomiting supervened. About 4 p.m. a medical man was called in to see the patient; he found her in bed quite cyanosed; cold; with cramps of the calves of the legs; constant purging and vomiting; stools "rice water" in character. The patient rapidly became worse and died at 7 p.m. A post-mortem examination was made on September 15th, when the following appearances were observed:—Rigor mortis well marked; the body was that of a well-nourished woman, the face was bloated and of a dusky hue, a yellowish, muddy discharge, which was slightly tinged with blood, was oozing from the nostrils and mouth. The pupils were somewhat dilated, the finger-nails were very cyanosed, there was hypostatic discolouration of the posterior parts of the body. There was a congested appearance of the exterior of the small intestines, but none of the large intestines; the posterior wall of the stomach was congested in the same manner as the small intestines. A portion of the small intestine was split open, when a congested surface was exposed. Stomach and intestines were empty, except a small amount of yellowish, muddy liquid. The liver was undergoing fatty degeneration, and the spleen was small and shrivelled in appearance; the kidneys were not examined. A portion of the lower ileum was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 181, Material XXIV.). Dr. Klein reported the results of his examination to be positively indicative of true cholera. The deceased was stated to have, prior to her illness, led a very irregular life, her home being a resort of organ-grinders and other persons of that class for immoral purposes; she was further stated to have been a hard drinker, and to have been subject to epilepsy. Neither she nor her husband had been out of Derby for some time before her attack, and no information could be obtained of anyone going to the house who had been the subject of any illness whatever. There had been, so far as could be ascertained, no illness of a diarrhœal nature amongst any of the inhabitants in the neighbourhood where C. N. lived. The usual precautions as to disinfection, were taken, and no further cases were reported.

Stockton-on-Tees.

On September 14th, a case of suspected cholera occurred at *Stockton-on-Tees* (Durham), which proved fatal on September 15th. The history of the case as supplied by Mr. J. H. Clegg, the Medical Officer of Health, is as follows:—R. L., male, aged 46 years, a carter, living in Bowser Street, Stockton-on-Tees, had been at work until noon on September 14th, when he was brought home suffering from severe sickness and diarrhœa ("rice-water" stools) and cramps in the legs with abdominal pain. When seen by Mr. Clegg, at 8 p.m., the patient's face was pinched and anxious; pupils slightly dilated; skin of face dusky, and of hands and arms very dusky; limbs quite cold; abdomen warm; no pain; sickness and diarrhœa much less than earlier in the day; voice weak; intellect clear; no pulse at wrists; heart's action very feeble; respiration 60, shallow and sighing; temperature in rectum, 104·2° Fahr. At that time the patient was in a state of collapse and evidently dying; death took place at 3 a.m. on September 15th. A partial post-mortem examination was made on September 15th, the abdomen only being allowed to be opened. Rigor mortis well developed; face much shrunken; nearly all the small intestines of a rose-coloured hue externally, and the mesenteric veins filled with dark-coloured blood; liver dark and slightly enlarged; gall bladder full of bile; spleen almost black and very slightly enlarged; bladder contained a few drops of urine. The small intestine was opened in various places, but there was no sign of ulceration; contents of intestine in upper portion milky and of consistence of thin cream, in lower portion colour of pea-soup. A piece of the lower ileum was sent

to Dr. Klein for bacteriological examination (*see* Appendix B., page 181, Material XXV.). Dr. Klein reported the results of this examination to be negative as to the presence of Koch's comma bacillus. No evidence of exposure to infection could be obtained. The usual precautionary measures were taken and no further cases were reported.

St. Luke.

On September 14th a schoolboy residing in *St. Luke's* (London), was suddenly seized about 10 p.m. with symptoms choleraic in character, and was admitted to St. Bartholomew's Hospital soon after midnight. The history of the case, summarized from the hospital records, is as follows:—E. C. E., male, aged five years, schoolboy, living in Gee Street, St. Luke's, was quite well up to 10 p.m. on September 14th, at which time he was suddenly seized with severe vomiting and diarrhœa; in an hour and a half his bowels were opened six or seven times, accompanied with abdominal pain; motions loose and light coloured. On admission to the hospital, at 12.45 a.m. on September 15th, patient was pale and dusky; complexion earthy; eyes sunken and half closed; conjunctive injected; tongue clean and dry; sores on lips and teeth; breath warm; voice weak; pulse small, only just perceptible at wrist; respiration shallow and hurried; temperature 97° Fahr.; abdomen rigid, no tenderness; hands and feet dusky and cold; skin dry; extremely restless; no cramps; little abdominal pain; much thirst. For the first four or five hours patient was much collapsed; his restlessness was extreme; vomiting ceased about an hour after admission; bowels acted about six times in the first 24 hours; motions light in colour with white flakes, almost "rice water" in character, extremely offensive; urine suppressed for 24 hours. There were no cramps. After 12 noon on September 15th patient began steadily to improve. Temperature:—sub-normal after the first 24 hours, highest 99·6° Fahr. at 3 a.m. on September 15th. He was discharged cured on September 20th. A portion of a "rice-water" stool passed on September 15th was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 180, Material XXIII.). Dr. Klein reported that whilst from the microscopical examination there was some suspicion of the presence of comma-bacilli, cultivations proved negative as regards Koch's commas. No evidence could be obtained of the patient having been exposed to cholera infection, and with the exception of a piece of apple which the child had eaten at 6 p.m. on the day of attack, there was no history of improper food having been taken. No further cases were reported from this district.

Blackburn.

On September 17th, a person at *Blackburn* (Lancashire), who had been suffering from diarrhœa for some days, developed symptoms suspicious of cholera, and died on the following day—September 18th. The history of the case as supplied by Dr. Wheatley, the Medical Officer of Health, is as follows:—C., male, aged 40 years, living in Princes Street, Blackburn, had been to Wigan on September 12th and got wet through, he returned home somewhat exhausted; on the following day he was attacked with diarrhœa, which, however, was not severe enough to prevent his continuing his work. On September 14th he went to Lytham (20 miles), and returned home the same day worse. On September 15th the diarrhœa was much worse, and the patient stayed in bed. On September 16th, a medical man was consulted for the first time; he found the patient suffering from vomiting and diarrhœa; motions a mixture of fœculent material and mucous-like substance; the vomited matters had a greenish tint; pulse, fair; no collapse; temperature, 99° Fahr.; no pain; great thirst. In the evening diarrhœa somewhat less. On September 17th, in the morning, the diarrhœa was less, and

the general condition of the patient improved. At 4.30 p.m., patient was seized with violent vomiting and diarrhœa, which persisted incessantly until 8 p.m., both vomited matter and stools "rice water" in character. On September 18th, at 2·30 a.m., diarrhœa less, but patient much collapsed. At 5·30 a.m., collapse increasing; face drawn; skin cold and clammy; temperature, 96° Fahr. in mouth; pulse, 128, hardly perceptible; voice, whispering; aching of limbs and back; no abdominal tenderness; mind clear. The diarrhœa stopped about 6 a.m. At 1.30 p.m. breathing more rapid; urine suppressed (catheter passed, no urine in bladder, and none passed for about 24 hours); patient died at 2.50 p.m. A sample of the bowel discharges from the patient was forwarded to Dr. Klein for bacteriological examination (*See* Appendix B., page 182, Material XXIX.). Dr. Klein reported that the material had apparently been disinfected before being forwarded, and that the cultivations were sterile. The deceased had been travelling about before his illness, but no history could be obtained of his having been to any town where cholera existed, or of his having been in contact with any infected person. The usual precautions were taken, and no further cases were reported from the district.

River Tyne Port.

On September 17th the steward of the barque "Jeannie," lying in the *River Tyne* Port Sanitary District, was attacked with symptoms, suspicious of cholera, and died the next day. The following notes of the case were supplied by Dr. Armstrong, the Medical Officer of Health:—H. C. H., male, aged 59 years, steward on board the "Jeannie," complained of feeling ill about 11.30 a.m. on September 17th, and went to bed. About 3 p.m. he was seized with severe diarrhœa (watery stools) and vomiting. There were no cramps. The patient died on September 18th. He was not seen by a medical man before death. A portion of the intestine was forwarded to Dr. George Murray for bacteriological examination, and he reported that the contents of the intestine "contained comma-bacilli." The barque "Jeannie," which had left Quebec on June 27th, arrived at the Tyne Port on August 4th, and had been lying there to the date of the deceased's illness. No history of any communication with persons, things, or places previously infected with cholera could be obtained. The vessel was disinfected, and no further cases occurred on board.

Hackney.

On September 18th a person residing at *Hackney* (London) was attacked with illness suspected to be cholera, and was admitted the same day into St. Bartholomew's Hospital, where he ultimately recovered. This patient was seen by Dr. Copeman, on behalf of the Board, and the following history has been partly drawn up from his memorandum and partly from the hospital records:—T. S., male, aged 26 years, residing at Ottaway Street, Hackney, was quite well until 1 a.m. on September 18th, when he woke up with pains in the abdomen, vomiting, and diarrhœa; cramps in the legs began after about ten minutes; the purging was stated to have been almost incessant until 2 p.m., when it stopped; stools "rice water" in character. At 3.15 p.m. the patient was admitted into hospital. On admission he was in state of collapse; skin cold; pinched appearance; eyes sunken; very restless; frequent retching, with little watery vomit; temperature, 99·2° Fahr. At 7 p.m. little less pain; vomiting ceased; temperature, 98·2° Fahr. The patient had a very restless night, with cramps in the legs. On September 19th general condition improved; temperature, morning, 96° Fahr.; evening, 98·4° Fahr. The patient passed no urine for 24 hours after admission. He continued to improve, and made a rapid recovery, and was discharged cured on September 26th. His temperature re-

mained subnormal. A sample of one of the "rice-water" stools, passed on September 18th, was forwarded to Dr. Klein for bacteriological examination (*See* Appendix B., page 182, Material XXXV.). Dr. Klein reported the result of his examination to be negative as regards comma-bacilli. For the two days prior to this patient's attack his meals had been as follows:—September 16th, breakfast, bloater; dinner, whelks; tea, eggs and bacon. September 17th, breakfast, eggs and bacon; dinner, hot roast pickled pork; tea, winkles; supper, cold pork and greens. His wife and child partook of the same food and remained well. The usual precautions as to disinfection were taken, and no further cases were reported from the district.

Liverpool.

On September 18th, a police constable at *Liverpool* (Lancashire), was attacked by symptoms suspicious of cholera, which proved fatal on September 19th. The history of the case, as obtained from local sources, is as follows:—W. T. C., male, aged 29 years, police constable, residing in Elwy Street, Liverpool, had been on duty during the night of September 17th and returned home shortly after 6 a.m. on September 18th. He went to bed, where he remained until noon, when he got up apparently well and had, with other persons in the house, dinner consisting of cold roast pork, sage, and onions. About 5 p.m. he went out for a walk, and on return said he had had a slight attack of diarrhœa. He went to bed about 6.30, but in less than half-an-hour he was attacked with vomiting and purging. He then went to see a medical man and fainted whilst in his surgery and again on his return home. At 10 p.m., as the patient appeared to be worse, another medical man was sent for, and on his arrival he found W. T. C. cold, exhausted, and almost pulseless; at that time the patient, who had been purged six times since 8 p.m., complained of cramps in his legs and abdomen. He became insensible about 1 a.m. on September 19th and died at 6 a.m. In view of the suspicious nature of the symptoms, an inquest was held and the evidence adduced not being satisfactory to the jury the inquest was adjourned for a post-mortem examination to be made by Dr. Barr. At the adjourned inquest Dr. Barr gave the results of his examination as follows:—Post-mortem rigidity was present and well marked; the body was a dusky grey colour, but there was only slight post-mortem lividity; the skin and subcutaneous tissue contained little or no fluid, putrefaction of the skin over the abdomen had commenced; the heart was soft and flabby, and all cavities contained thick, dark fluid blood of the consistence of tar; both lungs were congested, especially on their posterior aspects, with thick, dark tarry blood; there was œdema of the lungs, the congestion was very recent and must have occurred just before death; the liver was quite blanched and contained scarcely any blood; the kidneys also were bloodless; the spleen was very dark, almost black, and friable. The intestines were very translucent and contained a considerable quantity of very liquid "rice-water" like material; the blood-vessels of the small and large intestines were enlarged; the intestinal walls were very thin and the mucous membrane was almost completely stripped of its epithelium; the structure of the brain was healthy. A piece of the lower intestines and a portion of one of the stools were forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 182, Material XXXI.). Dr. Klein reported that whilst the results of the microscopical examination demonstrated the presence of comma-bacilli, the cultivations all remained sterile, owing to the fact that glycerine had been added to the specimens before they were forwarded to him. A second piece of the intestine accordingly was forwarded to Dr. Klein for examination (*see* Appendix B., page 184, Material XLI.). Dr. Klein reported the result of his examination of this specimen to be typical of true cholera.

The Medical Officer of Health reported that there was no evidence of the means by which the disease had been contracted, and that no other person in the house suffered from the disease. No further cases of reputed cholera occurred in Liverpool until the afternoon of October 6th, when a man residing in Northumberland Street was attacked by vomiting and purging, followed by cramps in the arms and legs. When seen on October 7th by a medical man the patient was in a state of collapse, and died at 4 p.m. on that day. A post-mortem examination was made by Dr. Roberts, who reported as follows:—"The intestines, which, on the peritoneal aspect were pinkish " and somewhat sticky to the feel, contained 12 ounces of a slightly " sanious fluid of the consistence of thin oatmeal gruel. This fluid " was loaded with epithelium and débris. The mucous surface of the " small intestines was denuded in a great measure of its epithelium, and " there were numerous sub-mucous extravasations, especially towards " the cæcal end. The stomach contained about 10 ounces of a thin " white fluid, and the mucous coat was pale with numerous points of " extravasations showing underneath. The right side of the heart was " full of thick, tarry-looking blood. The lungs were somewhat " shrivelled, and on putting the hand into the pleural cavity, the sticky, " soapy feel was very marked (this was observable, but not to the same " degree in the peritoneal cavity). There were numerous sub-pleural " extravasations on the lungs. The liver was pale, and the gall " bladder very distended. The spleen was small—weighing less than " five ounces." A portion of the intestinal contents was forwarded to Dr. Barron, Professor of Pathology in the University College, Liverpool, for bacteriological examination. Dr. Barron reported that the material had given cultivations which were indistinguishable from those of Koch's cholera bacilli. No connexion with any previous case of disease of a choleraic nature could be traced—the patient had eaten some mussels on the day when he was attacked. No further cases were reported from Liverpool during 1893.

North Bierley.

On September 18th the first of a series of seven attacks of choleraic illness, of which six proved fatal, occurred at *North Bierley* (Yorkshire). All the cases commenced in the fortnight ended October 1st. Five of the patients were members of the same family; of the remaining two patients, one had nursed and the other had helped to lay out one of the earlier cases. A piece of the ileum of the patient first attacked, whose death occurred on October 3rd, and a sample of the dejecta of a person who was attacked late in the series were forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 185, Materials XLV. and XLV*a*.). Dr. Klein reported that, as regards the first case, the cultivations gave negative results, whilst in the second case the results obtained were typical of cholera. The outbreak was made the subject of a special inquiry by Dr. Bulstrode, whose detailed report will be found in Appendix A., No. 14., page 151. The origin of the infection was not satisfactorily traced. No further cases were reported from the district.

Lewisham.

On September 20th a person residing in *Lewisham* (London) was attacked with diarrhœa, and as he subsequently developed symptoms suspicious of cholera, was removed to St. Bartholomew's Hospital on the following day. The history of the case, as obtained from the hospital records, is as follows:—A. B., male, aged 15 years, printer, residing in Thesiger Road, Penge, Lewisham, was attacked with diarrhœa and abdominal pains, on September 20th; in the evening after the commencement of the symptoms the patient ate a bloater. On Sep-

tember 21st, after having had a good night, the abdominal pain returned about 6 a.m.; at 8 a.m. he suffered from vomiting; at 10 a.m. he was admitted into St. Bartholomew's Hospital, and was at that time much collapsed; vomited frequently a bile-stained viscid fluid; slight cramps in the legs; some purging, stools light coloured, but not "rice water" in character; temperature, 98° Fahr. On September 22nd, general condition much improved; temperature—morning 96·8° Fahr., evening 97·4° Fahr. His progress towards recovery was rapid, and he was discharged cured on September 26th. A sample of one of the stools passed on September 21st was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 182, Material XXXII.). Dr. Klein reported the result of his examination to be negative as regards comma-bacilli. No history could be obtained in this case of the patient having been exposed to infection, or of his having eaten anything likely to disagree with him prior to his attack. The usual measures as regards disinfection were taken, and no further cases were reported.

Newcastle-upon-Tyne.

On September 21st, Dr. Armstrong, the Medical Officer of Health for Newcastle-upon-Tyne, reported the occurrence of two cases of severe diarrhœa accompanied by vomiting, cramps, and collapse, in a house in Conyers Road, *Newcastle-upon-Tyne* (Northumberland), one patient being attacked on September 20th and the other on September 21st. Both cases proved fatal, the one on September 21st and the other on September 22nd. Bacteriological examination of the discharges was made by Dr. George Murray, Professor of Comparative Pathology and Lecturer on Bacteriology, University of Durham College of Medicine, who reported that in his opinion both patients had suffered from "Asiatic cholera," Koch's comma-bacilli being found in the matters vomited by the first person attacked and in the bowel discharges of the second. On October 2nd Dr. Armstrong reported the occurrence of a case of suspected cholera at a fish shop in Nelson Street, Newcastle-upon-Tyne. The patient in this instance was attacked on October 1st, and as she was too ill to be removed to hospital was treated at home. She was stated to have suffered from diarrhœa, vomiting, cramps, and collapse, with a temperature of 95·2° Fahr. and an imperceptible pulse. This patient ultimately recovered. Some of the bowel discharges were examined by Dr. George Murray, who reported that he found the comma-bacilli of Asiatic cholera. As the patient was reported to have eaten some "Dutch native oysters," on September 28th, some oysters of the same batch were submitted to bacteriological examination, with, however, negative results. On October 9th a case suspicious of cholera occurred in the person of a woman residing in Drury Lane, Newcastle-upon-Tyne, who for a month prior to attack was reported to have been drinking heavily of beer. In this case there was reported to be acute diarrhœa, with vomiting and cramps; there was, however, no huskiness of voice or lividity of surface, and the evacuations are stated not to have presented any appearances characteristic of cholera. Specimens of the discharges were submitted to Dr. George Murray, who, after having made a bacteriological examination, pronounced them to contain the "bacilli of Asiatic cholera." The patient ultimately recovered. In all the above cases, except that which commenced on October 2nd, the patients were removed to hospital, and all necessary measures as to disinfection taken by the Medical Officer of Health. No connexion with any previous case was traced.

On September 22nd W. B., male, aged 49 years, residing at Cavendish Road, *Idle* (Yorkshire), who had been suffering for some

Idle.

days from diarrhœa, was suddenly attacked with violent vomiting and purging, accompanied by cramps of various muscles. The patient is stated to have been greatly collapsed, with cold extremities, and only able to speak in a whisper. His countenance was stated to be anxious and sunken, and his pulse imperceptible at the wrist. The symptoms persisted for some 36 hours, and then the patient gradually improved. Dr. Honeyburn, the Medical Officer of Health, examined some of the dejecta on the morning of September 22nd, and reported that he found numerous comma-shaped bacilli on microscopical examination, and upon making cultivations he obtained almost pure culture of comma-shaped bacilli, that he could not distinguish from the comma-bacilli of Asiatic cholera. A sample of the dejecta was forwarded to Dr. Sims Woodhead on September 23rd for bacteriological examination. Dr. Sims Woodhead reported that the result of his examination, both microscopical and bacteriological, gave positive evidence of cholera. No history could be obtained of the patient having been in communication with any person or place infected prior to his attack, or of his having eaten any suspicious food. The patient eventually recovered, and no further cases were reported from the district.

Islington.

On September 23rd a person residing at *Islington* (London) suffered from symptoms of a choleraic nature. The following history was supplied by the Medical Officer of Health of the London County Council :—A. K., male, aged 53 years, living at a lodging-house in Campbell Road, Islington, was attacked on September 23rd at 8 p.m. with abdominal pain, vomiting, diarrhœa, and cramps in the limbs. At 11 p.m. he was admitted to the St. Mary's Infirmary, Islington; on admission he was stated to have been much collapsed, and to have been suffering from severe vomiting and diarrhœa; the stools were described by the nurse to have been like "rice water." An hour or two after admission to the infirmary he began to improve, and quickly rallied; on the following day he was quite convalescent. There was stated to have been no other cases of similar illness in the lodging-house whence he was removed. The patient was a vagrant, and had been to several places in the neighbourhood of London prior to his illness. On September 19th he went to Wood Green, returning to Islington at night; a day or two later he went to St. Mary Cray and slept at a lodging-house there, the address of which he could not give. He had while at St. Mary Cray eaten some damsons and boiled pork, but had not had any shell-fish. On September 23rd, the day when his illness began, he returned from St. Mary Cray. No bacteriological examination was made in this case, as the stools had not been preserved.

St. George-the-Martyr, Southwark.

On September 23rd a man resident at Quinn's Square, Waterloo Bridge Road, in the district of *St. George-the-Martyr, Southwark* (London), was attacked with diarrhœa, which subsequently assumed a choleraic character, and which proved fatal on September 26th. From information furnished by the Medical Officer of Health of the London County Council, the following history has been drawn up :—R. W., male, aged 60 years, glass-cutter, was attacked with diarrhœa on September 23rd; on September 24th the diarrhœa diminished in the earlier portion of the day, but returned in the evening; on September 25th he went to work, but was compelled to return home at noon on account of severe diarrhœa accompanied with vomiting. On September 26th the vomiting and purging continued, and the motions are stated to have been blood-stained; the patient collapsed in the evening and died at 10 p.m. There was abdominal pain throughout the illness, but the patient never complained of any cramps in his limbs. A post-mortem

examination was made on September 27th, at 3 p.m., with the following results :—Body of a fairly well-nourished man ; rigor mortis well marked ; heart normal ; some old adhesions at apex of right lung, engorgement and œdema of lungs, but no hepatisation ; spleen not enlarged ; liver pale and friable ; kidneys, normal ; intestines injected throughout their whole length ; a small collection of fluid in the peritoneal cavity : the intestines contained some pink fluid ; there were sub-mucous hæmorrhages in the lower ileum and large intestine, these hæmorrhages were specially well marked in the head of the cæcum and on the colon. A portion of the lower ileum was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 183, Material XXXIX.), Dr. Klein reported the results of his examination in this case to be positively indicative of cholera. There was no history to be obtained of any exposure to infection. The deceased, with his family, had taken up his residence in Quinn's Square about four weeks before his attack. No strangers were subsequently entered as tenants in the block, with the exception of a family which came in after the commencement of R. W.'s illness. Nothing definite could be discovered with regard to the man's movements during the days immediately preceding his illness ; it was, however, ascertained that he had not slept away from home. No further cases were reported from this district during 1893.

Rowley Regis.

On September 23rd two persons residing in Lower Chapel Street at Tividale, in the *Rowley Regis* Urban Sanitary District (Staffordshire) were attacked by choleraic illness, from which one (a female aged 60 years) died on September 24th, 23 hours after the onset of the disease ; the other (a female, aged 60 years) recovered. On September 24th two more persons living near those already referred to, were attacked with similar symptoms, and of these one (a female aged 47 years) died on September 25th, after an illness of 21 hours. A portion of the ileum of this patient was sent to Dr. Klein for bacteriological examination (*see* Appendix B., page 183, Material XXXVIII.). Dr. Klein reported the results of his microscopic and bacteriological examination to be typical of true cholera. Subsequently four further cases of choleraic disease were reported from the same locality, two (a female aged 30 years, and a male aged 67 years) on September 25th, and two (a female aged 31 years and a male aged 5 years), all of whom ultimately recovered. Dr. Sweeting made inquiry into the circumstances of the outbreak on behalf of the Board, and his detailed report will be found in Appendix A., No. 15, page 155. No definite connexion with any previously infected person or place was made out.

West Malling. [Malling Rural District.]

On September 24th, a case with symptoms suspicious of cholera occurred at *West Malling*, in the Malling Rural Sanitary District (Kent), which proved fatal on September 26th. From the report of Dr. Butterfield, the Medical Officer of Health, it appears that E. F., female, aged 43 years, had walked to Maidstone, a distance of five miles, on September 23rd, wheeling a perambulator. She returned at 7 p.m., apparently quite well, and ate some sausage-turnover, of which her husband also partook for supper. At 7 a.m. on September 24th she became faint and was violently purged. During the course of the day the purging was accompanied by vomiting and cramps of the extremities; these symptoms continued during the next day, and the patient died at 7.40 p.m. The intestinal discharges are stated to have assumed a "rice water" character on September 25th. A portion of the bed-linen which had been saturated with intestinal discharges was sent to Dr. Klein for bacteriological examination (*see* Appendix B., page 184,

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Material XLII.). Dr. Klein reported the results of his examination to be doubtful as regards cholera, results possibly due to the "disinfection" of the sheet before being forwarded. No history could be obtained of any exposure to previous infection; neither the woman's husband nor any persons living in the neighbourhood suffered, so far as can be ascertained, from diarrhœa. The usual precautions were taken and no further cases were reported.

Coton Hill Asylum.

On September 26th an inmate (aged 52 years) of the Coton Hill Private Asylum (Staffordshire), was attacked with symptoms suspicious of cholera and died the same day. A second inmate (aged 56 years) was attacked on September 29th with similar illness, which proved fatal in eight hours. A portion of the ileum of the second patient was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 184, Material XLIII.). Dr. Klein reported the result of his examination to be positive as regards the presence of Koch's comma-bacilli. A special inquiry into the circumstances of this outbreak was made on behalf of the Board by Dr. H. T. Bulstrode (*see* Appendix A., No. 16, page 159). No connexion with any previous case of cholera was established. Stringent measures of disinfection were adopted and no further cases were reported.

Battersea.

On September 30th a suspicious case of choleraic illness occurred at *Battersea* (London), which proved fatal on October 2nd. The history as furnished by the Medical Officer of Health of the London County Council is as follows:—E. R., female, aged 70 years, living in Ponton Road, Battersea, was attacked with diarrhœa on September 30th, which continued throughout the day; the character of the evacuations was not ascertained, and the diarrhœa is stated to have ceased in the same evening and not to have returned. There was no record of any pain. On October 2nd the patient suffered from vomiting, the general conditions became weaker, and she died in the evening. There was no other illness in the house. The patient is stated to have eaten no fish of any kind; her diet had always been very simple. She had not been from home for upwards of a year prior to her illness. She had been subject to fainting fits from time to time. There was no post-mortem or bacteriological examination made in this case.

Crondall. [Hartley Wintney Rural District.]

On October 2nd, at *Crondall*, in the Hartley Wintney Rural Sanitary District (Hampshire), occurred the first of a series of diarrhœal attacks, choleraic in character, affecting certain members of two households. The following summary of the outbreak has been supplied by Mr. Denny, the Medical Officer of Health:—Rose B., female, aged 14 years, living at Heath Lane, Crondall, was attacked on October 2nd with vomiting, purging, and abdominal pains; temperature, 101° Fahr.; tongue, dry. The diarrhœa and vomiting persisted from 24–36 hours and were succeeded by a certain amount of collapse; temperature, subnormal. The patient was quite convalescent on October 9th.

Ruth B., female, aged 37 years, mother of Rose B., was attacked suddenly on October 3rd with symptoms similar to those referred to above, but much more severe in character, accompanied by cramps in the calves of the legs, in the abdomen, and in the arms. This patient became much collapsed, but ultimately became convalescent and was quite well on October 16th. A sample of the bowel discharges from this patient was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 185, Material XLIX.). Dr. Klein reported that upon microscopical examination it apparently contained some comma-shaped bacilli, but cultivations proved negative as regards the presence of Koch's comma-bacilli.

Albert B., male, aged 6 years, son of Ruth B. and brother of Rose B., was attacked on October 3rd with similar symptoms to those referred to in the case of Rose B., but in this case the symptoms were much milder in character and the patient was quite well on October 10th.

Edith T., female, aged 15 years, niece of Ruth B., and residing in the same neighbourhood, was similarly attacked on October 5th, but in this case the cramps were slight. This patient was well on October 16th.

Edwin T., male, aged 45 years, fish seller, father of Edith T., was attacked on October 22nd with purging, vomiting, pains in the abdomen, very severe cramps in the calves of his legs, followed by slight collapse; recovered October 26th.

Jane S., female, a nurse, was similarly attacked with diarrhœa, vomiting, and pain in abdomen on October 23rd, this patient, however, soon rallied and was quite well on October 26th.

All the patients lived in two out of a small row of four houses. The husband of Ruth B. was a journeyman bootmaker and worked at Aldershot. Edwin T., in following his trade as a fish seller, visited numerous places, most frequently, Aldershot. Jane S. came from Odiham the day before she was attacked with illness; none of the other persons attacked had been from home for some time before their illness. The water supply was obtained from a deep well, the water of which was stated to be contaminated at the time with "vegetable and other matter." No history of exposure to infection could be obtained. Disinfection was duly carried out and no further cases were reported.

Gloucester.

On October 2nd, a man at *Gloucester* (Gloucestershire) was attacked with choleraic illness which proved fatal the following day. The history of the case as supplied by Dr. J. Campbell, the Medical Officer of Health, is as follows:—C. W., male, aged 64, gardener, living in Alma Place, Gloucester, was apparently in good health until the afternoon of October 2nd, when he was seized, whilst at work in his garden, with violent purging and vomiting, followed by cramps in the extremities and the abdomen. These symptoms persisted throughout the night, and the next day the patient became collapsed, and death took place at 8 p.m. (October 3rd). A piece of the ileum of this patient was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 184, Material XLIV.). Dr. Klein reported the result of his examination to be negative as regards the presence of comma-bacilli. There was no history of the deceased having eaten any food likely to have given rise to the symptoms observed. Prior to his attack he had been in fairly good health, and had not suffered from diarrhœa. The usual steps as to disinfection were taken, and no further cases were reported.

Ormskirk.

On October 7th, Mr. J. J. Hanly, L.R.C.P.E., of Ormskirk, Lancashire, forwarded to Dr. Klein for examination some bowel discharges from a patient who had been attacked by choleraic disease at Green Lane, *Ormskirk*, on October 6th. The history of the case, as furnished by Mr. Anderton, the Medical Officer of Health, and by Mr. Hanly, the medical attendant, is as follows:—P. K., male, aged 33 years, attacked by vomiting and purging about midnight on October 5th–6th, and at 2 a.m. Mr. Hanly was summoned and found patient suffering from persistent diarrhœa and vomiting; temperature 97° Fahr.; pulse 150, thready; surface of body cold and cyanosed; cramps attacking limbs at short intervals; urine suppressed. Death occurred at 4.30 a.m. on October 9th. The deceased was said to have been in his usual health prior to his attack, and to have partaken, on October 5th, of a hearty dinner of pea-soup and bacon, and to have had tea with bread and butter in the evening. A

post-mortem examination was made and a portion of the ileum forwarded to Dr. Klein. An account of the results of Dr. Klein's examination of the bowel discharges and of the lower ileum will be found in Appendix B., page 185, Materials XLVIII. and L. respectively. In neither instance were positive results as regards cholera obtained.

Balby. [Doncaster Rural District.]

On October 7th a child residing at *Balby*, in the Doncaster Rural Sanitary District (Yorkshire), was attacked with choleraic symptoms and died the same day. The facts of the case as supplied by Dr. Mitchell Wilson, the Medical Officer of Health, were as follows:—M. E. L., female, aged six years, residing at Carr Hill, Balby, was attacked about 4 a.m. on October 7th with vomiting and purging. A doctor saw the child for the first time about noon the same day. He found her in a state of collapse and passing watery stools as she lay in bed; she died at 6 p.m. Three days later, on October 10th, H. L., male, aged 10 years, a brother of M. E. L. was attacked in the early morning with severe pains in the body, vomiting and purging; stools "rice water" in character; this child ultimately recovered. A sample of one of the "rice-water" stools of the latter patient was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 185, Materials LI.). Dr. Klein reported the result of his examination to be typical of true cholera; the material upon cultivation affording an almost pure culture of Koch's comma-bacillus. Both children had attended school regularly until the afternoon of October 6th (Friday), and before that date they had neither of them been away from Balby. The water used by the family for drinking purposes was obtained from a well in the back yard near the house. On chemical analysis the water was found to be very much polluted, and upon opening the well, leakage was seen to be entering it from partly blocked drains situate close to the well. No connexion with any previous case of choleraic illness could be traced. The necessary disinfection was carried out and no further cases were reported.

Rawmarsh.

On October 9th, a person resident at *Rawmarsh*, was attacked with symptoms highly suspicious of cholera, which had a fatal result on October 10th. The history of the case, as supplied by Dr. Picken, the Medical Officer of Health, is as follows:—M. A. M., female, aged 42 years, residing in Pens Lane, Rawmarsh, suffered from slight diarrhœa on October 9th, but went about her duties as usual, and at 5 p.m. was sitting on her doorstep knitting. Between 5 and 6 p.m. she was found lying upon the ground in a state of collapse; thereafter there was persistent vomiting, but not much evacuation from the bowels. The bowel discharges were stated to have been clear, like water. When seen at 11.30 p.m. the patient was in a state of collapse; features pinched; lips blue; pulse imperceptible; voiceless; temperature under 95° Fahr.; and complaining of pain and cramps in the arms and legs and pain in the back. She died at 5 a.m. on October 10th. The stomach and parts of the intestines were removed shortly after death and forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 186, Material LII.). The results of Dr. Klein's examination were confirmatory of cholera. The Medical Officer of Health could not ascertain that the diseased had eaten any shell-fish, fish, or anything unusual prior to her attack. There had been no visitor at her home; she had, however, been to Rotherham for a short time on the evening of October 7th, but no connexion with any previous case of cholera could be traced. The usual measures of disinfection were carried out, and no further cases were reported from the district.

Keighley.

On October 13th a case of reputed cholera occurred at *Keighley* (Yorkshire), which proved fatal the same day. The history of the case as supplied by Dr. Scatterty, the Medical Officer of Health, is as follows:—L. D., female, aged 59 years, living in South Street, Keighley, was on October 12th apparently in her usual health, except for the fatigue resulting from nursing a sick daughter who had been suffering for some five weeks from some uterine complaint. During the afternoon of October 12th, L. D. ate an apple and partook of apple pie for supper. About 3 a.m. on October 13th she awoke with vomiting, diarrhœa, and gastric pain; the diarrhœa got worse and, cramps having set in, a medical man was called in about 9.30 a.m. From 9.30 a.m. until 5 p.m. the symptoms persisted, and at 5.15 p.m. death took place. No post-mortem or bacteriological examination was made in this case. Except the apple mentioned above it is stated that nothing of an irritating nature had been eaten, nor could any information as to connexion of the patient with any infected person or place be obtained. In fact the deceased is said to have hardly ever left the house for five weeks prior to her attack. Three subsequent cases of suspicious illness in the persons of three sisters were connected with the case; one sister lived at Ingrow in the Bingley Township District (*see* page 46, *post*), and the other two at Hey Gardens, Keighley. The first of the sisters living at Keighley to be attacked was an unmarried woman between 60–70 years of age, who had with her other two sisters visited at the house of L. D. referred to above, during L. D.'s illness; and had assisted in the housework. She was attacked on October 14th, the day following L. D.'s death, with vomiting, diarrhœa, and cramps. Her attack was not very severe, and she ultimately recovered. The second sister, Mrs. B., a widow, aged 70 years, was attacked with diarrhœa, vomiting and cramps, on October 23rd, at 8.30 p.m. During the day she had been in her usual health and had washed certain articles belonging to her sister noted above, who was still suffering from diarrhœa. During the night the symptoms increased in severity, and the patient lost her voice and became collapsed. On October 24th, about 11.30 a.m., she died. During the earlier stages the evacuations are stated to have been yellow in colour, and later as watery and very profuse. A portion of the ileum of this case was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 186, Material LV.). Dr. Klein reported the results of his cultivations as typical of true cholera. No further cases were reported from this district.

Warrington.

On October 16th, Dr. Gornall, the Medical Officer of Health for *Warrington* (Lancashire), reported the notification of a suspicious case of "cholera nostras," which proved fatal the same day. The history of the case, as supplied by Dr. Gornall, is as follows:—T. J., aged 30, a navvy employed on the Manchester Ship Canal, came to Warrington, from Barton-upon-Irwell, on October 13th and took lodgings at a common lodging-house in the butter market. T. J. did not sleep at the lodging-house on the evening of the 13th, but is supposed to have slept in the fields. He stated that his illness began on the evening of October 13th with diarrhœa and great pain. On October 14th he suffered from slight sickness and from constant diarrhœa. The following day, October 15th, this diarrhœa still continued, and on October 16th, there being no improvement, he determined to go to the Workhouse for treatment, but became so ill on the way that he was taken to the surgery of a medical man, who at once notified the case to the Medical Officer of Health as suspicious of cholera, and he was thereupon admitted to the Fever Hospital. Upon admission, at

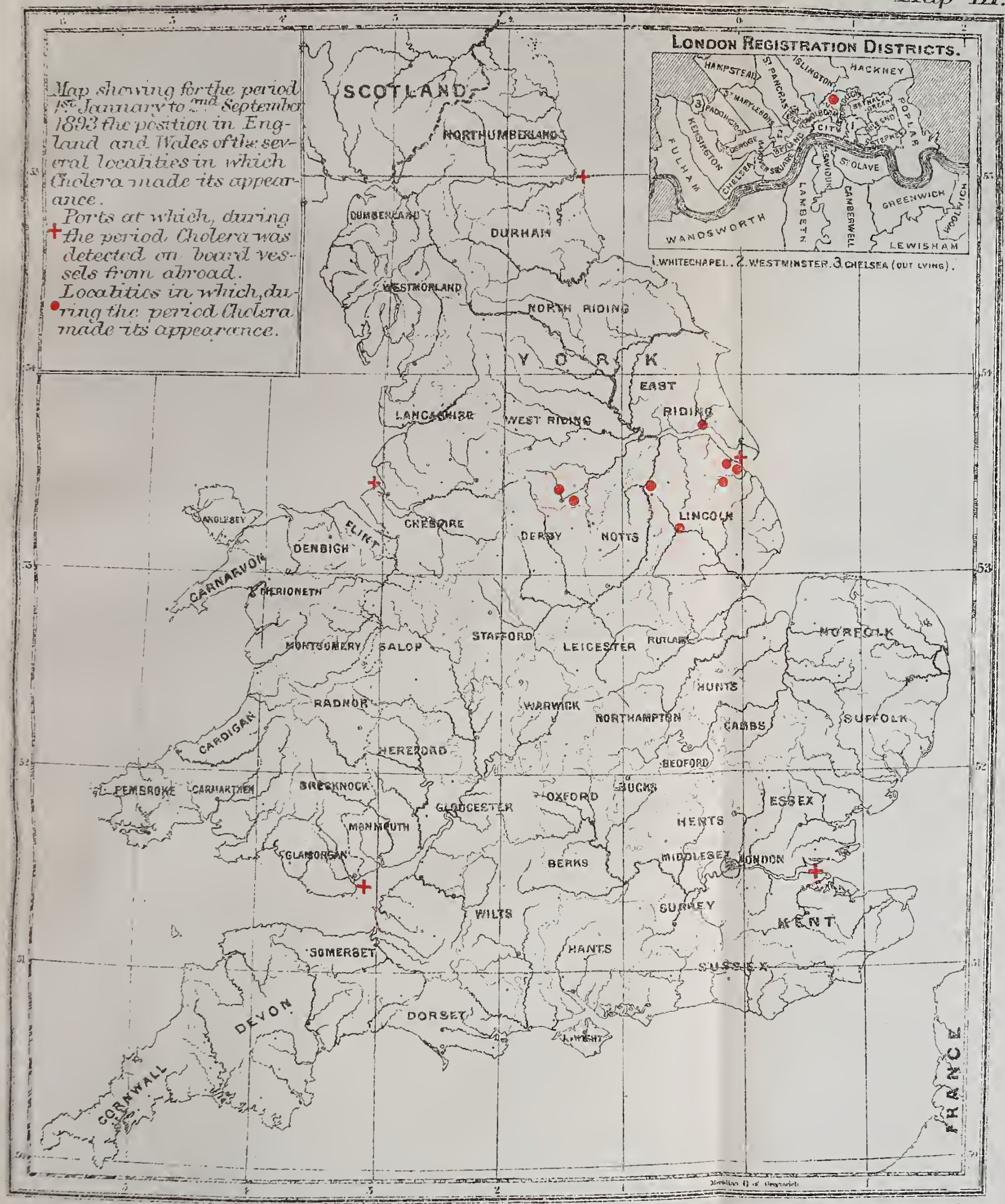
12.30 p.m., his temperature was 95° Fahr.; pulse very small; extremities cold with blueness of limbs; and patient apparently very weak. At 4 p.m., three motions since admission, fluid, brown, with a little solid matter in flakes; temperature 95° Fahr.; patient complained of pain, referred to epigastrum, sharp in character. Tongue furred, pointed; slight tenderness over most of the abdomen, chiefly referred to the left iliac fossa. At 8 p.m., temperature 92° Fahr. ; no improvement. Six motions since 4 p.m.; patient still complained of pain and was very restless—"rice water" stools. The patient died suddenly at 10.15 p.m. Upon making a post-mortem examination at 10.30 a.m., on October 17th, it was observed that the body was that of a well-developed muscular man. The rigor mortis was well marked, the veins of the abdominal wall were injected, the intestines generally were congested, and the small vessels injected. A portion of the ileum was forwarded to Dr. Klein for bacteriological examination (*see* Appendix B., page 186, Material LIII.). Dr. Klein reported the result of the examination to be negative as regards comma-bacilli. The common lodging-house was cleaned and white-washed; all bedding, &c., destroyed; all excrement and refuse removed and burnt in the destructor. No further cases were reported.

Bingley.

On October 16th, a woman residing at Ingrow, in the *Bingley* (Township) Urban Sanitary District (Yorkshire), was attacked with choleraic symptoms and died the same day. The following notes, with respect to this case, were supplied by Dr. G. R. MacGregor, the Medical Officer of Health. E. B., female, aged 62 years, married, residing at Damems Road, Ingrow, was seized on October 16th with sickness, diarrhœa, cramps in limbs and abdomen, followed by general collapse; tha patient died eight hours after the commencement of her illness. A portion of the ileum was forwarded to Dr. Klein for bacteriological examination. (*see* Appendix B. page 186, Material LIV.). Dr. Klein reported that the results of his culture experiments were indicative of true cholera. Prior to her illness the patient had been engaged in nursing a person (L. D.) at Keighley, who died on October 13th under similar circumstances, and a history of whose illness has already been given (*see* p. 45). All the clothing and bed linen were destroyed and the house thoroughly disinfected, and no further cases were reported from this district.

CHOLERA IN ENGLAND AND WALES 1893.

Map III.



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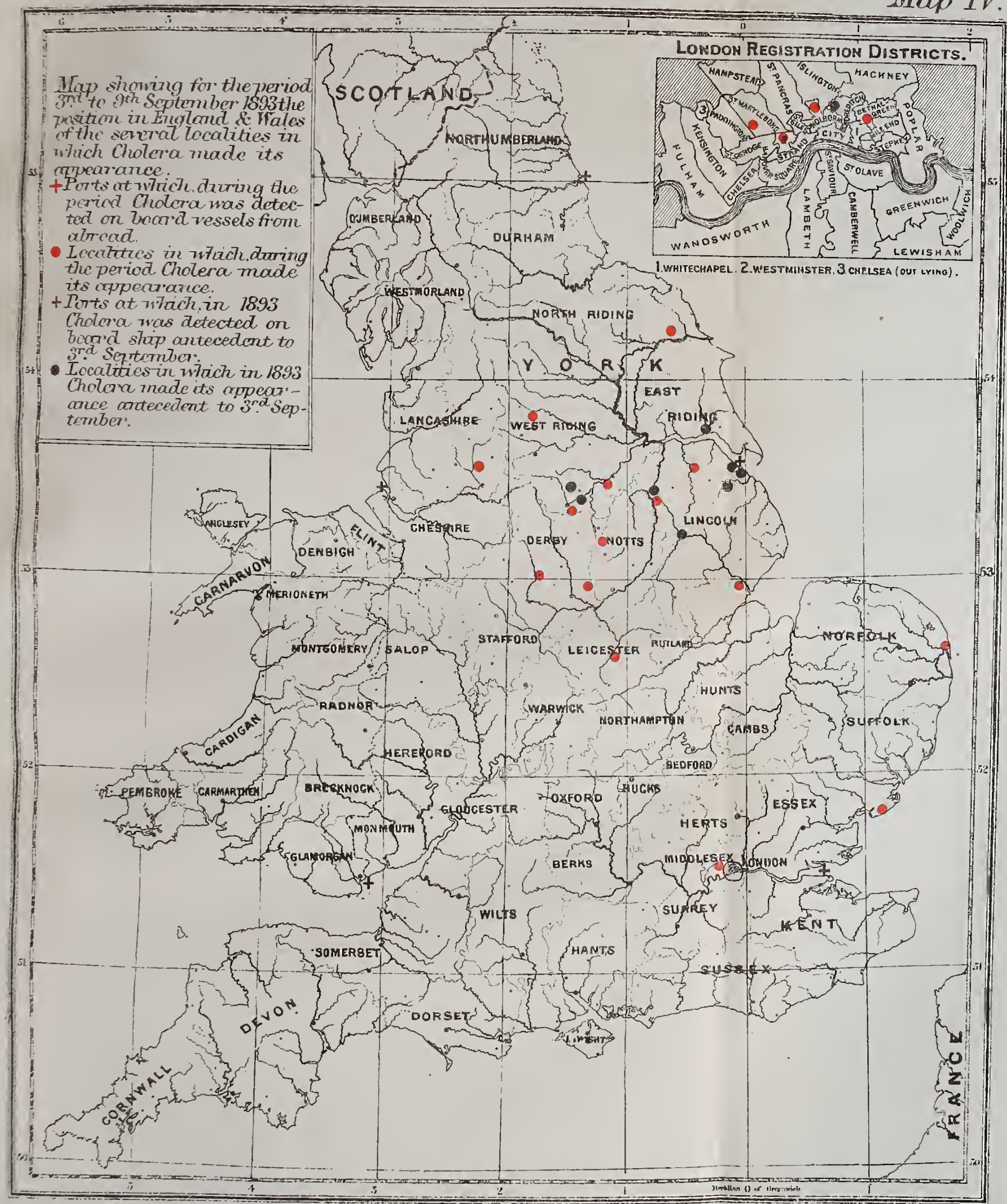
CHOLERA IN ENGLAND AND WALES 1893.

Map IV.



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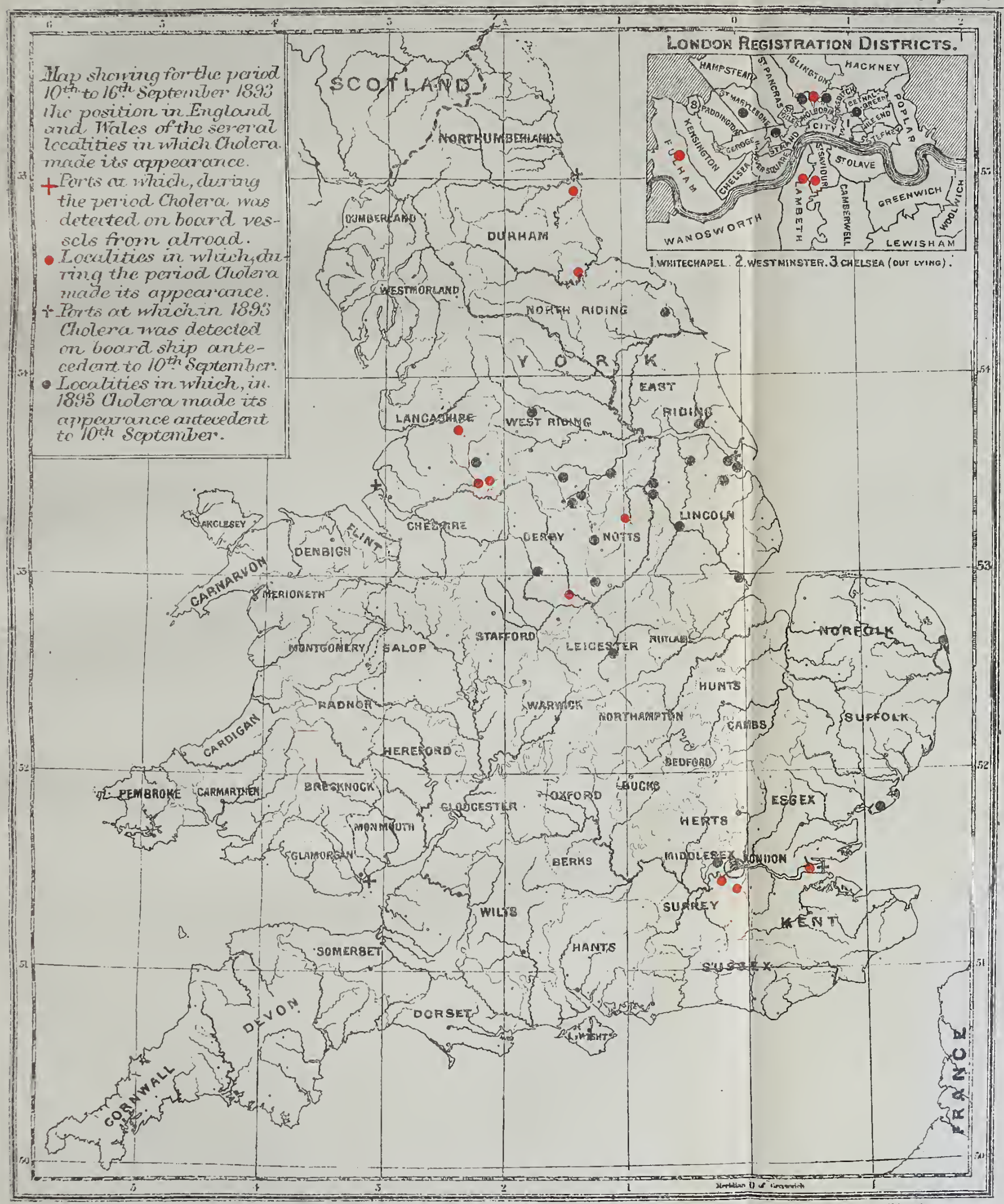
CHOLERA IN ENGLAND AND WALES 1893.

Map V.



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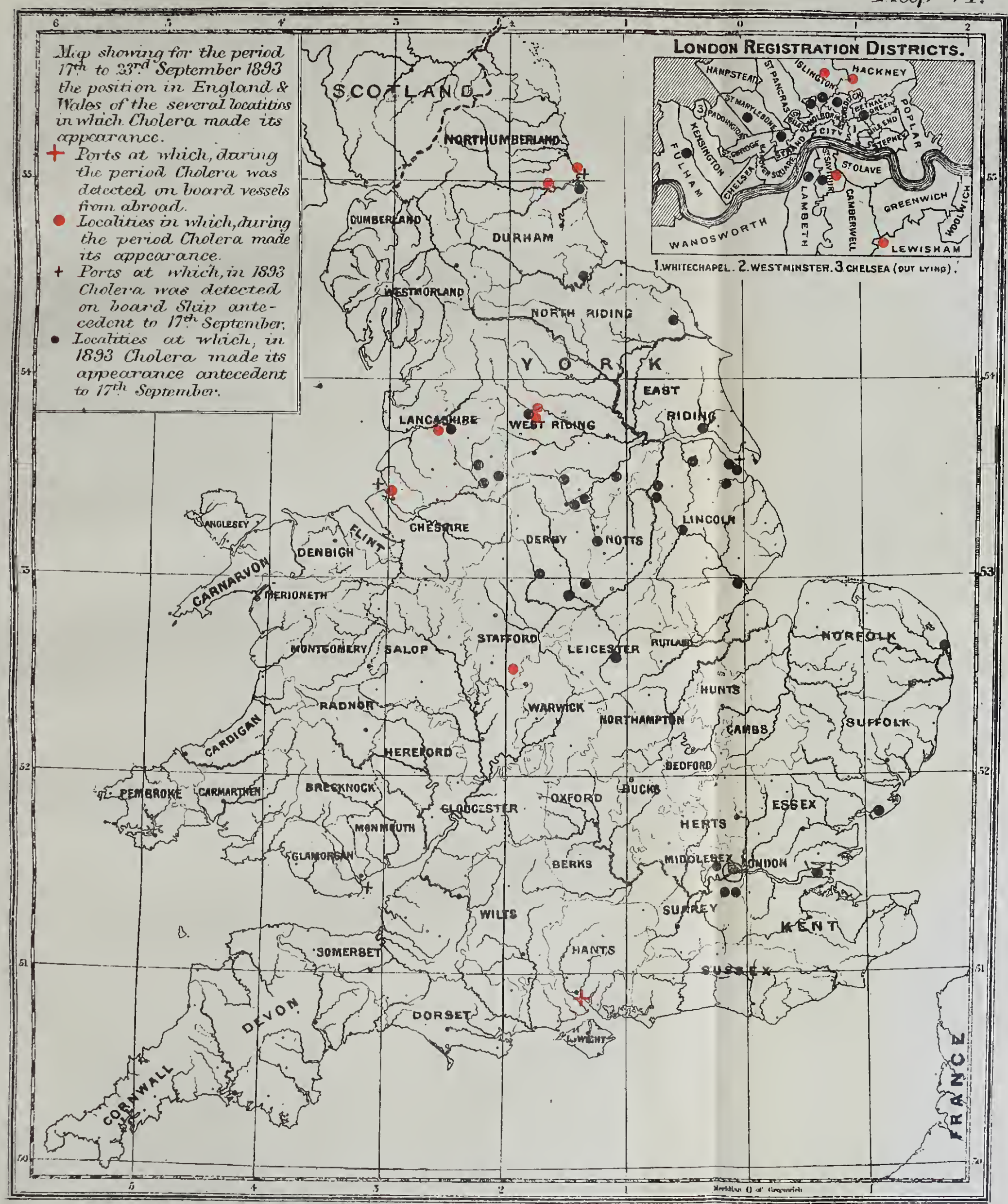
CHOLERA IN ENGLAND AND WALES 1893.

Map VI.



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CHOLERA IN ENGLAND AND WALES 1893.

Map VII.

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CHOLERA IN ENGLAND AND WALES, 1893.

Map VIII.

No. 2.

Report on Cholera in 1893 in the Borough of Great Grimsby and in the Local Board District of Cleethorpe-with-Thrunscoe; by Dr. Reece.

In consequence of information having been received by the Board of the repeated occurrence in the Great Grimsby Urban Sanitary District during the month of August of illness with symptoms resembling cholera, and of the circumstance that three persons had died of such disease in the period August 11th to August 20th, I was, on August 29th, instructed to proceed forthwith to Grimsby to investigate the nature and extent of the current malady, and to advise the Sanitary Authority respecting it.

I arrived at Grimsby on the evening of August 29th, and at once placed myself in communication with Dr. Newby, Medical Officer of Health, and Mr. Alderman Jacob K. Marshall, the Chairman of the Sanitary Committee. From these gentlemen I learnt that several further deaths had occurred since the 20th of the month which had been referred to "cholera nostras," and that these persons had already been buried. A fresh case, that of Mrs. P——, of Trinity Square, being notified during the night of August 29th, I went with Dr. Newby to the house of the patient, accompanied by Mr. C. Byron Turner, the medical practitioner in charge of the patient. In its clinical aspects this case was undistinguishable from Asiatic Cholera. The patient died early on the morning of the 30th August, and Mr. C. Byron Turner and Dr. Newby performed a post-mortem examination. A portion of the lower bowel of this case was transmitted to Dr. Klein for bacteriological examination, and he reported to the Board by telegram that the material sent him gave indication that this person had suffered from true cholera. Hereupon I was instructed by the Board to make detailed investigation of the outbreak, and of the conditions under which it had occurred.

Also I received information that the death of a woman, aged 26, had occurred on August 15th, at 28, Harrington Street, which street is in that part of the Cleethorpe-with-Thrunscoe Urban Sanitary District which is practically an extension of and just outside Grimsby town towards the east and south. This case, though probably belonging etiologically to Grimsby, will henceforward be allotted to Cleethorpes, to which statistically it belongs.

Accordingly I was instructed to extend my investigations to the Cleethorpe-with-Thrunscoe Urban Sanitary District.

Up to this date, 30th August, there had (as was subsequently ascertained) occurred in Grimsby, including the port district, 15 deaths referable to disease of the nature of cholera, as follows:—

Number of Death.	Date.	Name.	Sex.	Age.	Residence.	Duration of Disease.	Remarks.
1	Aug. 3rd	J. J. O.	M.	35	Engineer of S.S. "Dania."	4 days	Died in hospital ship of the Port Sanitary Authority.
2	„ 11th	F.	M.	49	59, Trinity Street	40 hours	A dock labourer. Supper of cockles the night before his death.
3*	„ 19th	G. R.	M.	16	92, Park Street -	14 hours	He had been employed at the Ice House near the docks.
4*	„ 20th	W. P.	M.	13	106, Grafton Street	12 hours	Died without receiving medical attendance.

* Death in these cases was certified as due to "diarrhœa." I have added them to the list, as from the history of the cases, their brief duration, and their fatal termination, I consider that they were probably cases of cholera.

Number of Death.	Date.	Name.	Sex.	Age.	Residence.	Duration of Disease.	Remarks.
5	Aug. 20th	Hn.	M.	41	Back of 44, Trinity Street.	24 hours	Master block maker at the fish docks, who drank much water when heated at his work. Said to have suffered from privation and want.
6	„ 20th	Ht.	F.	23	136, Rutland Street	28 hours	Supper of porter and fried fish.
7	„ 23rd	Wd.	M.	49	9, Trinity Square -	48 hours	Privation.
8	„ 24th	C.	M.	42	Back of 139, Hope Street (Charles Street).	24 hours	Coal-heaver at the docks. Drank much water.
9	„ 26th	B.	F.	11	Fifth Terrace, Hope Street.	11 days	Doubtful case.
10	„ 26th	M.	F.	29	144, Willingham Street.	12 hours	—
11	„ 27th	Ws.	F.	47	29, Spencer Street	15 hours	—
12	„ 28th	Wd.	F.	19	9, Trinity Square -	56 hours	Daughter of case 7.
13	„ 28th	Hwt.	M.	10	56, Acton Street -	21 hours	—
14	„ 29th	A child	?	2	Frazer Street -	9 hours	—
15	„ 30th	P.	F.	36	8 Trinity Square -	—	Nursed the baby of the Wd. family at No. 9, Trinity Square, while the father and daughter were ill.

In Cleethorpe-with-Thrunscoe Urban Sanitary District, in addition to the death on August 15th mentioned above, there had occurred at the same date (August 30th) two deaths from like cause, viz. :—

No.	Date.	Name.	Sex.	Age.	Residence.	Duration of Disease.	General Remarks.
1	Aug. 27th	N. C.	M.	76	Mill Road - -	7 days	Was taken ill at sea.
2	„ 29th	M. F.	F.	74	Fairfield House -	14 days	—

In order to elucidate the account now about to be given of the cholera prevalence in this part of England, it is necessary to describe shortly the two urban districts that were here involved.

The Great Grimsby Urban Sanitary District, with an estimated population of 54,000, is situated on the north-east coast of Lincolnshire, on the South Bank, and about seven miles from, the mouth of the Humber. The site of Grimsby is flat and low, lying but little above high-water mark. Much of the town is built on ground originally a marsh. Geologically, it is upon quaternary beds of warp and alluvium, under which is the Boulder Clay; between the Boulder Clay and the Chalk there is a more or less thin layer of gravel or sand. The Chalk forming the Lincolnshire wolds dips down before reaching the coast and passes under the Humber. A boring in Grimsby shows the Chalk at the depth of 66 feet.

Adjoining the Great Grimsby Urban Sanitary District, and south-east of it, is the Urban Sanitary District of Cleethorpe-with-Thrunscoe.

The portion of Cleethorpe-with-Thrunscoe Urban Sanitary District, (population 4,600) which abuts on the New Clee district of the Great Grimsby Urban Sanitary District, is thickly populated. It is practically a suburb of that town, which is extending an ever increasing distance into the Cleethorpes district. The village proper of Cleethorpes is situated more than a mile from New Clee, though the two places are

connected by a tramway, and by the Manchester, Sheffield, and Lincolnshire Railway, which has a station at Cleethorpes. During the summer months the population is largely increased by the influx of visitors. There is but little fishing trade; the chief industries being the letting of lodgings and the entertainment of "trippers," a large number of whom find their way to Cleethorpes. There are large oyster-beds situated off Cleethorpes where oysters are stored in preparation for sale, and these oysters are largely consumed by the visitors.

This village stands on the Boulder Clay, there being for the most part no alluvium or warp at the surface; beneath the clay is a layer of gravel and sand, below this gravel the Chalk.

For the purpose of facilitating comparison of the facts as to cholera prevalence in Grimsby and in Cleethorpes with those recorded by Dr. Theodore Thomson in regard of Hull, this report will deal *first* with Grimsby *then* with Cleethorpes under each of the headings adopted by Dr. Thomson, namely :—

I. Cholera and choleraic diarrhœa.
II. Diarrhœa.
III. Enteric fever.
IV. Distribution in *Time* of choleraic disease, diarrhœa, and enteric fever.
V. Distribution in *Area* of these diseases.
VI. Source of the cholera.
VII. Maintenance of cholera.
VIII. Sanitary administration.

I.—CHOLERA AND CHOLERAIC DIARRHŒA.

Grimsby.

The first death in the district in 1893 which was probably due to cholera occurred on board the hospital ship "Bradford." The patient was the engineer to the SS. "Dania," which arrived off Grimsby from Antwerp on August 2nd. He died the following night on the Port Sanitary hospital ship, and his death was registered as due to "choleraic diarrhœa." The corpse was landed to be buried, and conveyed direct to the Grimsby New Cemetery by the officers of the Sanitary Authority. The corpse, before burial, was wrapped in sheets soaked in carbolic acid, and quicklime was placed under and over the coffin in the grave. The "Dania" was sent to the Mooring Station and disinfected. No other person was sick on board, and the vessel on August 4th proceeded on her voyage to the North Sea.

The master of this vessel had come ashore in the ship's boat on the morning of his arrival, and after making inquiries, drove to the house of the Port Inspector of Nuisances, who returned with the master to the vessel. When the master landed, the Customs House Officers had not boarded the vessel, nor did they learn of his landing until long afterwards. It is supposed that the crew of the boat stayed in her while the master was ashore; but of this there is no definite knowledge.

Investigation undertaken to ascertain whether there had occurred in Grimsby antecedent to 2nd August, or between that date and August 11th, other cases which might have been of choleraic nature proved altogether negative. No such case could be discovered. Nor, after 11th August, were any cases heard of as having occurred before August 15th and 19th.

The fatal manifestations of choleraic disease in Grimsby subsequent to August 2nd as illustrated by *deaths* referred to cholera, cholera nostras, and choleraic diarrhœa, are recorded in the following table, Table I. A.

Table I. A.

Showing Deaths certified as due to Cholera, Cholera Nostras, and Choleraic Diarrhœa in Great Grimsby (Population estimated at 54,000) during the Period August 11th to October 8th, 1893.

No.	Date of Death.	Sex.	Age.	Duration of Disease.	Death Certificate.	Remarks.
1	Aug. 3rd	M.	35	4 days -	Choleraic diarrhœa -	Died in Port Hospital.
2	„ 11th	M.	49	40 hours -	Cholera nostras.	—
3	„ 19th	M.	16	14 „ -	Diarrhœa - -	These cases were, I consider, cases of cholera.
4	„ 20th	M.	13	12 „ -	Diarrhœa - -	
5	„ 20th	M.	43	24 „ -	English cholera.	—
6	„ 20th	F.	23	24 „ -	Cholera nostras.	—
7	„ 23rd	M.	49	2 days -	Cholera nostras.	—
8	„ 24th	M.	42	24 hours -	English cholera.	—
9	„ 26th	F.	29	12 „ -	Cholera nostras.	—
10	„ 26th	F.	11	11 days -	Cholera nostras.	—
11	„ 27th	F.	47	15 hours -	Cholera nostras.	—
12	„ 28th	M.	10	21 „ -	Cholera nostras.	—
13	„ 28th	F.	19	56 „ -	Choleraic diarrhœa.	—
14	„ 29th	M.	2	2 days -	Diarrhœa - -	Considered by Medical Officer of Health to have been a case of cholera.
15	„ 30th	F.	36	12½ hours	Cholera nostras -	Bacteriologically examined by Dr. Klein, and by him regarded as true Cholera.
16	„ 31st	M.	26	Not stated	Cholera morbus -	„ „
17	Sept. 1st	F.	42	24 hours -	Cholera morbus -	Had been nursing No. 20.
18	„ 2nd	F.	14	Not stated	Choleraic diarrhœa -	Died in hospital.
19	„ 2nd	M.	89	2 days -	Cholera nostras.	—
20	„ 2nd	F.	36	8 „ -	Cholera morbus -	Suppression of urine 40 hours.
21	„ 3rd	M.	40	Not stated	Asiatic cholera -	Died in hospital.
22	„ 4th	M.	54	12 hours -	Cholera - -	Son suffering from cholera.
23	„ 5th	F.	58	7 days -	Chronic diarrhœa -	Considered by Assistant Medical Officer of Health to be cholera. Son sent to hospital.
24	„ 5th	F.	62	3 „ -	Choleraic diarrhœa	—
25	„ 6th	M.	33	4 „ -	Asiatic cholera.	—
26	„ 7th	F.	44	Not stated	Cholera.	—
27	„ 7th	M.	2	24 hours -	Cholera - -	Died in hospital.
28	„ 9th	M.	83	8 days -	Cholera nostras.	—
29	„ 9th	M.	67	24 hours -	Choleraic diarrhœa.	—
30	„ 11th	M.	45	9 days -	Cholera - - -	Died during a relapse.
31	„ 11th	M.	50	5 „ -	Cholera - -	Died in hospital.
32	„ 12th	M.	51	12 hours -	Cholera morbus.	—
33	„ 16th	M.	45	Not stated	Choleraic diarrhœa -	Died in hospital.
34	„ 19th	M.	49	„	Cholera - - -	Died in hospital.
35	Oct. 6th	M.	36	„	Cholera.	—
36	„ 8th	M.	48	53 hours -	Cholera.	—

Thus the number of deaths from disease of the nature of cholera in Grimsby during August, September, and October amounted to 36 in all, corresponding to a death-rate from this cause of 0·66 per thousand of population.

In this respect, therefore, Grimsby suffered more heavily than Hull, in which town the death-rate last autumn from disease of this class did not exceed 0·08 per 1,000 population.

Also Grimsby suffered cholera earlier than Hull, as will be seen from the subjoined table giving the incidence in time of cholera-death in the two places.

Date in 1893.	Deaths from Cholera and Choleraic Diarrhœa in		Date in 1893.	Deaths from Cholera and Choleraic Diarrhœa in	
	Grimsby (population 54,000).	Hull (population 208,700).		Grimsby (population 54,000.)	Hull (population 208,700).
Aug. 3rd	1*	—	Sept. 10th	—	—
„ 4th	—	—	„ 11th	2	1
„ 5th	—	—	„ 12th	1	—
„ 6th	—	—	„ 13th	—	1
„ 7th	—	—	„ 14th	—	—
„ 8th	—	—	„ 15th	—	—
„ 9th	—	—	„ 16th	1	—
„ 10th	—	—	„ 17th	—	—
„ 11th	1	—	„ 18th		2
„ 12th	—	—	„ 19th	1	—
„ 13th	—	—	„ 20th	—	—
„ 14th	—	—	„ 21st	—	—
„ 16th	—	—	„ 23rd	—	—
„ 17th	—	—	„ 24th	—	2
„ 18th	—	—	„ 25th	—	1
„ 19th	1	—	„ 26th	—	1
„ 20th	3	—	„ 27th	—	—
„ 21st	—	—	„ 28th	—	—
„ 22nd	—	—	„ 29th	—	—
„ 23rd	1	—	„ 30th	—	—
„ 24th	1	1	Oct. 1st	—	—
„ 25th	—	—	„ 2nd	—	—
„ 26th	2	—	„ 3rd	—	—
„ 27th	1	—	„ 4th	—	—
„ 28th	2	—	„ 5th	—	—
„ 29th	1	—	„ 6th	1	—
„ 30th	1	—	„ 7th	—	—
„ 31st	1	—	„ 8th	1	—
Sept. 1st	1	1	„ 9th	—	—
„ 2nd	3	—	„ 10th	—	1
„ 3rd	1	2	„ 11th	—	—
„ 4th	1	1	„ 12th	—	—
„ 5th	2	—	„ 13th	—	—
„ 6th	1	2	„ 14th	—	—
„ 7th	2	1	„ 15th	—	—
„ 8th	—	—	„ 16th	—	—
„ 9th	2	—	„ 17th	—	—
			Total -	36	17

* The case previously mentioned as having been brought to the district by the S.S. "Dania."

Information as to *non-fatal* diarrhœal sickness in Grimsby was obtained as follows:—

On August 25th the Sanitary Authority requested, by circular, the medical practitioners of Grimsby to notify cases of a choleraic character.

This not producing the desired effect, on August 31st the Sanitary Authority decided to pay a fee of 2*s.* 6*d.* for each case notified, and a fee of 5*s.* for each case of diarrhœa prescribed for by the medical practitioners of the town; and they at once took steps for duly advertising their decision.

On September 1st notification of cases of "diarrhœa" was requested, the fee for such notification being 2*s.* 6*d.*; few cases were however notified until September 5th, and on September 6th choleraic diarrhœa became by a special order of the Board (issued under the Epidemic Regulations) compulsorily notifiable, in the urban district and port of Grimsby. The request of the Sanitary Authority for notification of diarrhœa was cancelled on September 11th, the fee being withdrawn at the same time. A few cases were however notified up to the morning of September 13th. The fee of 5*s.* for prescription for diarrhœa was withdrawn on September 23rd. Meanwhile notification of choleraic disease remained in force until the withdrawal of the Epidemic Regulations on January 8th, 1894. "Cholera" was notified throughout in accordance with the provisions of a local Act, which practically coincides with the Infectious Disease (Notification) Act, 1889. In addition to information thus acquired, the Sanitary Authority gained knowledge of cases of choleraic disease through their officers and in other ways.

All such cases, however ascertained, were investigated by the Medical Officer of Health or Assistant Medical Officer of Health, and as a result I am furnished with the following list of total cases of disease of choleraic nature. It does not profess to be exhaustive, and it includes fatal with non-fatal cases.

Table II. A.

Showing, day by day, the Number of Cases regarded as of the Nature of Cholera that occurred in Grimsby during the Period August 11th to October 14th, 1893.

Date.	No. of Persons attacked.	Died on Date in Col. 1.	Date.	No. of Persons attacked.	Died on Date in Col. 1.
Aug. 3rd		1	Sept. 8th	11	—
,, 11th		1	,, 9th	3	2
,, 19th		1	,, 10th	—	—
,, 20th		3	,, 11th	9*	2
,, 21st	8	—	,, 12th	1	1
,, 22nd		—	,, 13th	2	—
,, 23rd		1	,, 14th	2	—
,, 24th		1	,, 15th	3	—
,, 25th		—	,, 16th	1	1
,, 26th	7	2	,, 17th	2	—
,, 27th	3	1	,, 18th	3	—
,, 28th	1	2	,, 19th	2	1
,, 29th	1	1	,, 20th	1	—
,, 30th	1	1	,, 21st	1	—
,, 31st	1	1	,, 22nd	2	—
			,, 23rd	—	—
Sept. 1st	6	1	,, 24th	—	—
,, 2nd	14*	3	,, 25th	—	—
,, 3rd	3	1	,, 26th	—	—
,, 4th	8	1	,, 27th	—	—
,, 5th	9	2	,, 28th	—	—
,, 6th	7	1	,, 29th	—	—
,, 7th	8	2	,, 30th	—	—

* One case occurred on the shipping in the Alexandra Dock, and is hereafter included in the North-West Ward, in which ward the Alexandra Dock is situated.

Date.	No. of Persons attacked.	Died on Date in Col. 1.	Date.	No. of Persons attacked.	Died on Date in Col. 1.
Oct. 1st	—	—	Oct. 9th	1	—
„ 2nd	—	—	„ 10th	1	—
„ 3rd	—	—	„ 11th	—	—
„ 4th	—	—	„ 12th	—	—
„ 5th	1	—	„ 13th	—	—
„ 6th	—	1	„ 14th	1	—
„ 7th	4	—			
„ 8th	—	1	Total -	128	36

The apparent sudden increase of cases coming under notice at the beginning of September was due no doubt to the fact that at this date notification of choleraic diarrhœa carried with it a fee, which it had not hitherto done ; and it is probable, too, that a certain proportion of cases notified at this time as matter of fact occurred at a date antecedent to that at which they were recorded. So that the seeming high fatality of attacks recorded in August becomes to a corresponding degree discounted. On the other hand, the smaller fatality of attacks in September is perhaps referable to inclusion among the notifications in this month of cases not truly choleraic. But taking the figures as a whole the total of 36 deaths among 128 recorded cases, *i.e.*, a fatality of nearly 28 per cent., is a strong indication that the majority of cases notified as choleraic illness were in all probability examples of true cholera. In this respect Grimsby is in contrast with Hull, where the fatality of the recorded choleraic illness amounted to no more than 20 per cent., and this different fatality of the current cholera in the two places affords further indication of the far heavier incidence of true cholera on Grimsby than on Hull, which has already been adverted to.

Cleethorpe-with-Thrunscoe.

The first fatal case from disease of the nature of cholera, as far as could be ascertained, in this district was that of the woman, aged 26, who died on August 15th, after an eight hours' illness, at 28, Harrington Street, New Clee, a street which is situated in that part of the district which is really an extension of the town of Grimsby. Prior to this date there had been, in 1893, no deaths in Cleethorpes ascribed to choleraic disease, and none occurred later than September 8th.

The manifestations of disease of the nature of cholera as shown by the *deaths* recorded in the Urban Sanitary District were as follows :—

Table I. B.

Showing Deaths certified as due to Cholera, Cholera Nostras, and Choleraic Diarrhœa in the Cleethorpe-with-Thrunscoe Urban Sanitary District (Population estimated at 4,600) during the Period, August 15th to September 8th, 1893.

No.	Date of Death.	Sex.	Age.	Duration of Disease.	Death Certificate.	Locality.
1	Aug. 15	F.	26	8 hours -	Cholera nostras -	New Clee, adjacent to boundary of Grimsby.
2	„ 27	M.	76	7 days -	Diarrhœa - -	In the village of Cleethorpes.
3	„ 29	F.	74	14 „ -	Diarrhœa - -	„ „
4	Sept. 1	M.	45	6 „ -	Choleraic diarrhœa -	„ „
5	„ 2	F.	86	2 „ -	Choleraic diarrhœa -	„ „
6	„ 2	M.	56	12 hours -	Cholera - -	„ „
7	„ 8	M.	28	2 days -	Cholera morbus -	„ „

These seven fatal cases correspond to a death-rate in Cleethorpes of 1·52 per thousand in a population of some 4,600.

As to *non-fatal* cases, the Infectious Disease (Notification) Act, 1889, is not in force in the Cleethorpe-with-Thrunscoe Urban Sanitary District; the Sanitary Authority, although recommended by the Local Government Board to adopt the Act, have not done so.

Public notice that cholera and choleraic diarrhœa, had become compulsorily notifiable in Cleethorpes, as at Grimsby under the Epidemic Regulations of September 1st and 6th, was not issued by the Sanitary Authority of the district until September 8th. Meanwhile, however, information respecting occurrence of disease of choleraic nature had since the beginning of the month been obtained by the Medical Officer of Health from the medical men practising in the place; and with the result shown in the subjoined table.

Table II. B.

Showing, day by day, the Number of Cases regarded as of the Nature of Cholera that occurred in the Cleethorpe-with-Thrunscoe Urban Sanitary District during August and part of September 1893.

Date in 1893.	Number of Persons attacked by Choleraic Diseases.	Died on Date.	Date in 1893.	Number of Persons attacked by Choleraic Disease.	Died on Date.
Aug. 1st	—	—	Aug. 24th	—	—
„ 2nd	—	—	„ 25th	1	—
„ 3rd	—	—	„ 26th	—	—
„ 4th	—	—	„ 27th	1	1
„ 5th	—	—	„ 28th	—	—
„ 6th	—	—	„ 29th	—	1
„ 7th	—	—	„ 30th	—	—
„ 8th	—	—	„ 31st	1	—
„ 9th	—	—	Sept. 1st	—	1
„ 10th	—	—	„ 2nd	1	2
„ 11th		—	„ 3rd	1	—
„ 12th	—	—	„ 4th	—	—
„ 13th	—	—	„ 5th	—	—
„ 14th	—	—	„ 6th	1	—
„ 15th	1*	1*	„ 7th	2	—
„ 16th	—	—	„ 8th	1	1
„ 17th	—	—	„ 9th	—	—
„ 18th	—	—	„ 10th	—	—
„ 19th	—	—	„ 11th	—	—
„ 20th	1	—	„ 12th	—	—
„ 21st	—	—	„ 13th	—	—
„ 22nd	—	—			
„ 23rd	—	—	Total	11	7

* The fatal case already referred to, on the first page of this report, as occurring at Harrington Street, New Clee, in the suburbs of Grimsby.

From the above table it appears that, during the period August 15th to September 8th, 11 persons were within the knowledge of the

Sanitary Authority attacked by an illness judged to be choleraic in nature.

Cleethorpes, too, like Hull, suffered later than Grimsby, all of its cholera, except the case referred to as etiologically belonging to Grimsby, occurring in late August or early September.

II.—DIARRHŒA.

Grimsby.

The amount and the nature of "Summer Diarrhœa" in Grimsby in 1893 was also duly inquired about, not only with a view to ascertaining whether this disease had been unusually prevalent, but also for the purpose of determining whether true cholera, that had proved fatal, had not been in part included in the diarrhœa mortality.

Amount of Diarrhœa in Grimsby in 1893.

The amount of diarrhœa in Grimsby in 1893 is to be judged of in two ways; namely, by the number of deaths attributed to this cause, and by the diarrhœa attacks which came to the knowledge of the Great Grimsby Sanitary Authority during the period in which this malady was being notified

The total number of *deaths* ascribed to diarrhœa in Grimsby in 1893 was 125, which, the estimated population of Grimsby in 1893 being 54,000, gives a mortality from this cause of 2·3 per thousand persons living. Compared with the rate from the same cause in the 28 large towns of England and Wales during the ten years 1883–1892, which was 0·82 per thousand living, the Grimsby rate was exceptionally high.

But, as has been shown by Dr. Theodore Thomson, the diarrhœa death-rate was in 1893 unusually high throughout the country, and, accordingly, it is necessary, for just appreciation of the position of Grimsby in that year, to compare Grimsby with itself in this respect as regards former years, and the diarrhœa death-rate of the Urban Sanitary District in 1893 with that for other towns in the same year. In the absence of figures for complete comparison in the above sense for the whole year 1893, a table published by the Registrar General in his return for the third quarter of each year will suffice. It is in this quarter that by far the greater number of deaths from diarrhœa occurs in this country; and in this way, therefore, a sufficiently just means of comparison of diarrhœa incidence on various town districts is afforded. On the data thus provided is based the following table, Table III. A., in which is shown the diarrhœa death-rate in Grimsby in the third quarter of 1893, as well as in the ten years 1883–1892. Also the table affords means of comparison in this respect of Grimsby with Hull and with other towns as well as with England and Wales.

Table III. A.

Showing (as an Annual Rate) for Grimsby, Hull, England and Wales, "28 great Towns" and "67 other large Town-Districts," the Diarrhœa Mortality in the Third Quarter in each of the Eleven Years 1883–1893; and giving in each Instance, for comparison with 1893, the Mean of the Third Quarter Rates of the Ten Years 1883–1892.

Third Quarter of the Year.	Rate per 1,000 Population in each Instance.				
	Grimsby.	Hull.	England and Wales.	Great Towns.	Other large town Districts.
1883 - -	1·2	1·8	1·2	2·1	1·4
1884 - -	6·7	6·0	2·7	4·0	3·2
1885 - -	0·4	0·8	1·1	2·1	1·0
1886 - -	5·4	4·5	2·3	3·7	2·6
1887 - -	5·5	4·1	2·1	3·4	2·2
1888 - -	2·5	0·9	0·9	1·6	1·0
1889* - -	4·0	4·0	1·7	2·6	2·0
1890 - -	5·4	2·6	1·3	2·1	1·4
1891 - -	1·5	1·9	1·0	1·7	1·0
1892 - -	3·9	2·9	1·2	2·0	1·5
Average in 10 years, 1883–92	3·6	3·0	1·6	2·5	1·7
1893 - -	8·7	8·4	2·8	3·5	3·8

* In this year the boundary of the Great Grimsby Urban Sanitary District was altered and considerably increased.

From these figures it will be seen that the average death-rate from diarrhœa in Grimsby exceeds that of Hull, and is, moreover, considerably higher than the corresponding rates for England and Wales, for the "28 large towns," and for the "67 other large town-districts." Further it appears that the diarrhœa mortality in the third quarter of 1893 was increased in each of the areas under comparison, and that the diarrhœa death-rate was greatest of all in Grimsby. So far, therefore, as conclusion regarding prevalence of diarrhœa sickness may be arrived at from mortality from this cause, it would appear that Grimsby in this respect suffered in the third quarter of 1893, not only more than was usual in that borough, but also relatively more than did the remainder of the country, and to a greater extent even than its neighbour Hull on the other side of the Humber.

As to diarrhœa prevalence in the autumn of 1893, the facts as to the recorded number of diarrhœa *attacks* day by day during the period of September 1st to September 13th, during which the Sanitary Authority paid a fee for the notification of this malady, are given in the following table, Table IV. A.

Table IV. A.

Showing, Day by Day, the Number of Persons known to have been attacked by Diarrhœa in Grimsby during the Period September 1st to September 13th, 1893.

Date.	Number of Persons attacked.	Date.	Number of Persons attacked.
September 1st - -	2	September 8th - -	68
„ 2nd - -	1	„ 9th - -	65
„ 3rd - -	4	„ 10th - -	56
„ 4th - -	0	„ 11th - -	58
„ 5th - -	9	„ 12th - -	63
„ 6th - -	30	„ 13th - -	9
„ 7th - -	111		
		Total - -	476

Anterior to the time (September 1st) when medical practitioners commenced to notify diarrhœa sickness, there had been a large amount of diarrhœa in Grimsby, and, accordingly, the statistics as to diarrhœa sickness during the period September 1st to September 13th, represent a fraction only of the total diarrhœa sickness in Grimsby in the autumn of 1893. Nevertheless they suffice to show that during the period in which choleraic disease chiefly prevailed in Grimsby diarrhœa was also very abundant there. In the particular week September 6th to September 12th inclusive, the number of diarrhœa cases notified was 451; equal to a rate *annually* of 434 per thousand of the population.

In view of the demonstrated excess of diarrhœa in Grimsby in the third quarter of 1893, it is desirable to consider whether this unusual prevalence of the malady was accompanied by departure from the type of the ordinary summer diarrhœa in this country, which tends, as is well known, to be fatal mainly among infants.

Age Distribution of Deaths from Choleraic Disease and Diarrhœa in Grimsby in 1893.

The 36 deaths ascribed in Grimsby to disease of the nature of cholera and the 125 deaths referred to diarrhœa are classified in the following Table V. A. in certain age groups.

Table V. A.

Showing Number of Deaths attributed respectively to Disease of the Nature of Cholera and to Diarrhœa in the Great Grimsby Urban Sanitary District in 1893: classified according to Age.

Age Period.	No. of Deaths due to Disease of the Nature of Cholera.	No. of Deaths due to Diarrhœa.
Under 1 - -	—	98
1–5 - - -	2	17
5–15 - -	3	2
15–60 - -	27	4
Over 60 - -	4	4
At all ages -	36	125

The above figures show that of reputed cholera deaths in Grimsby upwards of 90 per cent. were at ages *over* five years; and that on the other hand, of deaths in the town ascribed to diarrhœa, more than 90 per cent. were at ages *under* five years. This wholly different incidence on age of the one and the other accepted cause of death is not inconsistent with the fatal malady, reputed to be cholera, having been true cholera, and with the fatal diarrhœa having been in the main, not cholera, but the ordinary summer diarrhœa of this country. At the same time it affords no sufficient basis for inference that much of the fatal diarrhœa of the third quarter of 1893, which affected infants, was not after all of the nature of true cholera.

As to the precise nature of *non-fatal* diarrhœa in Grimsby in 1893, no trustworthy information is forthcoming with reference to that occurring antecedent to the appearance of cholera in the town. During prevalence of cholera, however, cases of illness made their appearance which, in view of the circumstances under which they occurred, locally obtained the name of "infective diarrhœa." Some of these cases were seemingly notified indifferently as "choleraic diarrhœa" and as "diarrhœa"; but others were not, so far as I could ascertain, notified at all. The class of diarrhœa now in question is indicated by the following notes taken in regard of particular cases.*

Case I.—M.A.B., 51 years of age, had been attacked on August 2nd by vomiting and purging, which lasted a day or two and left her in a weak condition. On September 9th she was again attacked, the onset being ushered in by vomiting and purging, followed by cramps in the legs and abdomen; extremities cold. The patient remained in this condition for 24 hours; the vomit and stools became "frothy"; gradually reaction set in and diarrhœa ceased on September 19th. Very little urine was passed during the first few days of the illness. Her hearing became impaired during the attack, and it remained so afterwards. No satisfactory explanation of her illness was forthcoming. Her husband, a joiner, had assisted at the end of August and the early part of September in placing in their coffins the bodies of certain patients who had died from cholera. He suffered from malaise afterwards, and had pains in the head and abdomen, but no diarrhœa.

Case II.—E.P., aged 18 years, 15, Bridge Street. On September 9th she visited M.A.B., Case I. On September 13th she came home to dinner as usual, and after partaking of her dinner of meat and potatoes, she ate a raw potato and returned to her work (trawl net braiding). She was quite well at 2 p.m. Soon after commencing work she was attacked with cramps in her right calf, pains in lower hypogastric region, followed by diarrhœa, stools rapidly becoming "watery." She walked home; on the way she vomited three times in the street, the vomit being "watery fluid." On her arrival home she was placed in bed; the extremities were then cold, face pinched and dusky. This condition continued until the next day, September 14th, when she perspired copiously. No urine was passed between the time of the attack on 13th and the morning of September 15th. On September 16th temperature rose to 100° F. On September 18th she got up convalescent.

Case III.—A.P., aged 23, 15, Bridge Street, nursed the preceding case. On September 16th, 3 a.m, she vomited and went to stool five times, but suffered no pain. At 9.30 a.m. seized with cramp in abdomen and chest. Extremities became cold and legs drawn up to the body. There was severe headache and buzzing in the ears. Face cyanozed. No urine was passed between September 17th and 21st. Diarrhœa and vomiting ceased on September 17th. She was able to sit up on September 20th, when she presented a very anæmic and emaciated appearance.

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* For the notes of these cases I am indebted to Mr. Pryce Jenkins, one of the Medical Visitors.

Case IV.—E.B., 19 years. Living in the same house as Case I. Was attacked on September 16 at 8 a.m. with diarrhœa and vomiting. Cramps in abdomen and legs set in during the day. Legs rigidly drawn up. Extremities cold. Severe headache and buzzing in the ears. No urine passed on 16th and 17th, when the patient began to convalesce.

Case V.—E.P., age 57, of 15, Bridge Street, assisted to nurse Cases II. and III., E.P. and A.P. On September 18th she had a feeling of malaise and went to bed in the afternoon. On September 19th she was attacked with diarrhœa and vomiting and pains in the limbs, the extremities were cold, and she complained of dizziness in the head. Diarrhœa ceased on September 20th.

It would appear that cases of diarrhœa of this description were cases of cholera of a mild type; and the following account of similar disease, occurring in the shipping, is confirmatory of this.

On September 1st a sailor on board the Norwegian sailing ship "Elizabeth," lying in the Alexandra Dock, was attacked with symptoms of cholera and removed to the "fever" hospital. Vessels unloading in the Alexandra Dock are principally timber vessels, and the vessels stay in dock several days while the process of unloading the timber is being carried on. The ship "Elizabeth" had arrived from Sweden on 27th August. The sailor in question had been on shore at Grimsby the night of August 31st. This vessel was not removed from the dock, but disinfected where she lay. In the next few days two members of the crew were similarly attacked by diarrhœa, vomiting, and cramp. They quickly recovered, being only ill a few hours, but for the time they suffered from most of the symptoms of cholera in a mild degree. They were not removed from the vessel.

Diarrhœa subsequently made its appearance in one ship after another lying in the Alexandra Dock, attacking a large per-centage of the various crews; in one case as many as 14 on a single vessel, the entire crew. It also appeared on board vessels in the Union Dock, which is continuous with the Alexandra Dock, the two docks being only separated in name. Most of the vessels lying in these docks were attacked. Also at this time there was a certain amount of diarrhœa on board the fishing smacks. As a rule the fishermen do not remain on their vessels, but leave them as soon as they reach dock and go to their homes in Grimsby or Cleethorpes. Some cases of diarrhœa of a severe type occurring in fishermen in the town became known to the Sanitary Authority, but from the habits of the sailors it is quite possible that many cases occurred in which medical assistance was not sought.

Cleethorpe-with-Thrunscoe.

The total number of *deaths* ascribed to diarrhœa in the Cleethorpe-with-Thrunscoe Urban Sanitary District in the third quarter of 1893 was 12, which, the estimated population of the district in 1893 being 4,600, gives a mortality from this cause of 10·4 *annually* per thousand persons living. This rate is six to seven times the average rate (1·6) in Cleethorpes in the third quarter of the preceding three years, and, moreover, it greatly exceeds the corresponding rates in 1893 for Grimsby and Hull, and for other towns. Comparison of the rates in question is afforded in the following table (III. B.).

Table III. B.

Third Quarter of Year.	Diarrhœa Death-rate per 1,000 Population in each Instance.				
	Cleethorpes.	Grimsby.	Hull.	Great Towns.	Other large Towns.
Average 1890–92 -	1·6	3·6	2·5	1·9	1·3
„ 1893 -	10·4	8·7	8·4	3·5	3·8

There can be no question, therefore, that Cleethorpe-with-Thrunscoe suffered exceptionally in the third quarter of 1893 from fatal diarrhœa.

As to the nature of this excess of diarrhœa in Cleethorpes in the third quarter of 1893, nothing for certain is known. The facts, as to age distribution, show that the deaths referred in 1893 to diarrhœa were, as in Grimsby, most abundant at ages under 5 years.

Table V. B.

Showing the Number of Deaths attributed respectively to Disease of the Nature of Cholera and to Diarrhœa in the Cleethorpe-with-Thrunscoe Urban Sanitary District in 1893: classified according to the Age.

Age Period.	No. of Deaths due to Disease of the Nature of Cholera.	No. of Deaths due to Diarrhœa.
Under 1 - -	1	11
1–5 - - -	—	1
5–15 - -	—	—
15–60 - - -	3	1
Over 60 - -	3	—
At all ages -	7	13

As to *non-fatal* diarrhœa in Cleethorpes, no definite account can be given since "diarrhœa" was not notifiable there at any time. The number of attacks that came to the knowledge of the Sanitary Authority are likely to have fallen considerably short of those which actually occurred, but so far as is known the "diarrhœa" cases occurring day by day between September 1st to September 13th (the period dealt with as regards Grimsby) numbered 29. The ages of these persons are not known, and other facts recorded respecting them are meagre; so that the precise nature of these attacks remains doubtful.

TABLE IV. B.

SHOWING, day by day, the NUMBER of PERSONS known to have been attacked by DIARRHŒA in the CLEETHORPE-WITH-THRUNSCOE URBAN SANITARY DISTRICT during the Period September 1st to September 13th, 1893.

Date.	No. of Persons attacked by Diarrhœa.	Date.	No. of Persons attacked by Diarrhœa.
September 1st	—	September 9th	—
„ 2nd	—	„ 10th	4
„ 3rd	—	„ 11th	3
„ 4th	—	„ 12th	1
„ 5th	—	„ 13th	1
„ 6th	4		
„ 7th	—	Total	29
„ 8th	16		

III.—ENTERIC FEVER.

GRIMSBY.

In Grimsby in 1893 the number of cases of enteric fever notified to the Sanitary Authority as having occurred in the district was 326, and the deaths referred to this cause in the course of the year were 54.

In Grimsby in 1893 therefore 60·4 out of every 10,000 persons living were attacked by enteric fever, and 10 out of every 10,000 persons died of this disease. The following figures afford means of contrasting these rates with corresponding rates for other places and for Grimsby itself in other years :—

Sickness	*Grimsby :* Sickness-rate from enteric fever per 10,000 of population in 1893	60·4
	Hull : Sickness-rate from enteric fever per 10,000 of population in 1893	32·0
	41 *Notification towns :* Sickness from enteric fever per 10,000 of population in 5 years 1883–87	14·0
Mortality	*Grimsby :* Death-rate from enteric fever per 1,000 of population in 1893	1·00
	Hull : Death-rate from enteric fever per 1,000 population in 1893	0·43
	Grimsby : Death-rate from "fever"* per 1,000 population in the years 1882–91	0·42
	Hull : Death-rate from "fever"* per 1,000 population in the years 1882–91	0·26
	Twenty-eight large towns : Death-rate from "fever"* per 1,000 population in 10 years 1882–91	0·25

Hence it appears that not only did Grimsby suffer in 1893 a considerably greater amount of enteric fever than is usual in that borough, but that the attack-rate and the death-rate there from this cause was markedly greater than in Hull and in other towns.

* "Fever" includes, in addition to enteric fever, typhus and simple well-defined forms of continued fever.

Cleethorpe-with-Thrunscoe.

The amount of enteric fever in 1893 in the Cleethorpe-with-Thrunscoe Urban Sanitary District can only be judged of by the deaths from this cause. The Infectious Disease (Notification) Act, 1889, is not in force in the district.

The enteric fever deaths registered in 1893 amounted to 5, which gives a death-rate from this cause of 1·08 out of every thousand persons.

Compared with the data for Grimsby and Hull the rate is a high one; but it is based on a small figure, and has, therefore, no great significance. Taken, however, with the facts respecting cholera and diarrhœa in the district, it fully supports the inference that alvine diseases were abnormally frequent in Cleethorpes in 1893.

IV.—DISTRIBUTION IN *TIME* OF DISEASE OF THE NATURE OF CHOLERA, OF DIARRHŒA, AND OF ENTERIC FEVER.

Grimsby.

Table VI. A. gives, week by week, for Grimsby the ascertained deaths ascribed to disease of the nature of cholera, and to diarrhœa respectively throughout the whole year; the ascertained attacks of choleraic disease during the period August 11th to October 14th; and the cases of enteric fever notified to the Sanitary Authority and the deaths from this cause throughout the whole year. *Vide* also Charts A. and B. in addendum to this report.

Table VI. A.

Showing Week by Week for 1893 the Number of Persons ascertained to have been attacked by Disease of the Nature of Cholera, and by Enteric Fever in Grimsby; as well as the Deaths in each week registered as due to Cholera Disease and to Diarrhœa in the same Borough.

Weekly Periods, 1893.	No. of Persons attacked by Disease of the Nature of Cholera.	No. of Deaths from Disease of the Nature of Cholera.	No. of Diarrhœa Deaths.	No. of Persons attacked by Enteric Fever.	No. of Deaths from Enteric Fever.
Week ending Jan. 7th	—	—	—	1	—
„ „ 14th	—	—	—	2	1
„ „ 21st	—	—	—	—	1
„ „ 28th	—	—	—	—	—
„ Feb. 4th	—	—	—	1	—
„ „ 11th	—	—	—	2	—
„ „ 18th	—	—	—	1	1
„ „ 25th	—	—	2	—	1
„ March 4th	—	—	—	—	—
„ „ 11th	—	—	—	—	—
„ „ 18th	—	—	—	—	—
„ 25th	—	—	—	2	—

Weekly Periods, 1893.	No. of Persons attacked by Disease of the Nature of Cholera.	No. of Deaths from Disease of the Nature of Cholera.	No. of Diarrhœa Deaths.	No. of Persons attacked by Enteric Fever.	No. of Deaths from Enteric Fever.
Week ending April 1st	—	—	—	5	—
" " 8th	—	—	—	1	1
" " 15th	—	—	—	1	—
" " 22nd	—	—	—	1	1
" " 29th	—	—	—	1	—
" May 6th	—	—	—	—	—
" " 13th	—	—	2	1	—
" " 20th	—	—	—	2	—
" " 27th	—	—	—	2	—
" June 3rd	—	—	—	2	—
" " 10th	—	—	1	—	—
" " 17th	—	—	—	1	—
" " 24th	—	—	—	2	—
" July 1st	—	—	1	4	—
" " 8th	—	—	—	3	—
" " 15th	—	—	3	3	—
" " 22nd	—	—	5	4	—
" " 29th	—	—	6	3	1
" Aug. 5th	—	—	15	8	1
" " 12th	1	1	19	9	1
" " 19th	1	1*	24	14	2
" " 26th	12	7*	21	11	3
" Sept. 2nd	27	10	10	30	1
" " 9th	49	9	7	24	3
" " 16th	18	4	2	20	5
" " 23rd	11	1	4	34	3
" " 30th	—	—	2	38	1
" Oct. 7th	5	1	—	22	6
" " 14th	3	1	—	13	5
" " 21st	—	—	—	12	5
" " 28th	—	—	—	10	—
" Nov. 4th	—	—	—	15	5
" " 11th	—	—	—	3	—
" " 18th	—	—	—	5	1
" " 25th	—	—	—	6	2
" Dec. 2nd	—	—	—	2	1
" " 9th	—	—	—	—	—
" " 16th	—	—	1	—	—
" " 23rd	—	—	—	3	1
" " 30th	—	—	—	1	—
" " 31st	—	—	—	1	1
Totals - -	127	35†	125	326	54

* One death registered as diarrhœa has been added here as being probably of choleraic nature.
† In these statistics the death on board the port hospital ship of the engineer of the "Dania" is not included.

Table VI. A. and the charts A. and B. alike show that fatal diarrhœa attained its maximum in Grimsby just antecedent to the date at which disease of the nature of cholera and enteric fever began largely to prevail there. And further they show that enteric fever exhibited a sudden increase just antecedent to the prevalence of cholera and was maintained subsequently at a level considerably above the average for the year long after cholera had disappeared from the town. Chart B. further illustrates the above facts, and especially exhibits the abruptness of the rise and fall of disease regarded as of the nature of cholera as compared with the rise and fall of enteric fever.

Cleethorpe-with-Thrunscoe.

Similar comparisons for Cleethorpes of the behaviour in time of disease of the nature of cholera, of diarrhœa, and of enteric fever has to be based on death returns alone; the Notification Act not having been yet adopted in this district.

Table VI. B.

Showing, Week by Week, from August to December 1893 the Number of Persons ascertained to have died from Disease of the Nature of Cholera, of Diarrhœa, and of Enteric Fever in the Cleethorpe-with-Thrunscoe Urban Sanitary District.

Weekly Periods, 1893.	No. of Deaths from Disease of the Nature of Cholera.	No. of Diarrhœa Deaths.	No. of Deaths from Enteric Fever.
Week ending August 5th -	—	—	—
„ „ 12th -	—	—	1
„ „ 19th -	1	3	—
„ „ 26th -	—	3	—
„ September 2nd -	5	1	—
„ „ 9th -	1	3	—
„ „ 16th -	—	—	1
„ „ 23rd -	—	2	—
„ „ 30th -	—	—	—
„ October 7th -	—	—	—
„ „ 14th -	—	1	1
„ „ 21st -	—	—	—
„ „ 28th -	—	—	—
„ November 4th -	—	—	—
„ „ 11th -	—	—	—
„ „ 18th -	—	—	—
„ „ 25th -	—	—	1
„ December 2nd -	—	—	—
„ „ 9th -	—	—	—
„ „ 16th -	—	—	1
„ „ 23rd -	—	—	—
„ „ 30th -	—	—	—
„ „ 31st -	—	—	—
Totals - -	7	13	5

The facts, so far as they go, show that fatal diarrhœa in Cleethorpes did not, as in Grimsby, precede prevalence of cholera. Both diseases commenced to be fatal in one and the same week, namely, that ending 19th of August; and the fact is not a little suggestive of the choleraic nature of the fatal diarrhœa occurring at this time in Cleethorpes. For the rest, fatal diarrhœa outlasted the disease registered in the local death records as cholera, and such fatal enteric fever as occurred in Cleethorpes manifested itself later in the main than did either cholera or diarrhœa.

V.—DISTRIBUTION IN *AREA* OF DISEASE OF THE NATURE OF CHOLERA, OF DIARRHŒA, AND OF ENTERIC FEVER.

Grimsby.

Contrast of the extent to which various parts of Grimsby were invaded by disease of the nature of cholera, by diarrhœa, and by enteric fever respectively is obtained by noting the number of known attacks of choleraic disease during the period August 11th to October 14th, of diarrhœa during the period September 1st to September 13th, and of enteric fever during the entire year, in each of the several wards of the borough.

Table VII.

Showing for each Ward and for the whole Borough of Grimsby the Number of Persons ascertained to have been attacked by Disease of the Nature of Cholera, and by Diarrhœa in certain Weeks of 1893, as well as the Number of Enteric Fever Cases notified during the entire Year; together with the Attack Rate from these causes per 1,000 population in each instance.

District.	Acreage.	Population.		Cholera and Choleraic Diarrhœa, Aug. 11 to Oct. 14.		Diarrhœa Sept. 1 to Sept. 13.		Enteric Fever during the whole Year.	
		Census of 1891.	As estimated by the Sanitary Authority in 1893.	No. of Attacks.	Attack Rate per 1,000 Population.	No. of Attacks.	Attack Rate per 1,000 Population.	No. of Attacks.	Attack Rate per 1,000 Population.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Humber - -	78	12,584	13,107	43	3·28	128	9·77	129	9·84
N.E. - -	107	10,544	9,991	24	2·40	107	10·70	31	3·3
N.W. - -	692	6,130	6,222	27*	4·33	58	9·32	32	5·14
S. - - -	1,028	5,699	5,699	3	·52	49	8·59	26	4·56
S.W. - - -	254	10,305	10,291	21	2·04	72	7·00	82	7·9
Wellow-Weelsby -	959	16,672	8,690	9	1·03	62	3·72	26	2·99
Borough of Grimsby	3,120	51,934	54,000	127	2·35	476	8·81	326	6·04

* Two cases included in this number occurred on the shipping in the Alexandra Dock, which is situated in this ward.

From this table it will be seen that as regards disease of the nature of cholera, the attack rate for the borough, from August 11th to October 14th, was 2·35 per 1,000 people living, and that this rate was exceeded in the Humber Ward (3·28) North-East Ward (2·4), and North-West Ward (4·33).

The diarrhœa attack rate for the borough, from September 1st to September 13th, was 8·81 per 1,000 people living; a rate which was exceeded in the Humber Ward (9·77), North-East Ward (10·70), and in the North-West Ward (9·32).

The enteric fever attack rate for the borough was 6·04 per 1,000 people per annum; a rate which was exceeded in the Humber Ward (9·84), and South-West Ward (7·96).

The fact that the Humber Ward, which, as is seen from the table, is the most densely populated of all the Grimsby wards, suffered exceptionally from all three of the diseases under investigation, raised the question as to how far crowding of population on area had been related to differences of prevalence of one and another malady. Accordingly the following subsidiary table was constructed for the purpose of ascertaining what were the ratios of the figures representing density of population, and amount of disease of the nature of cholera, of diarrhœa, and of enteric fever for each of the wards to the corresponding figures for the borough as a whole.

Subsidiary Table showing, for each of the Wards of Grimsby, Density of Population, and Cholera, Diarrhœa, and Enteric Fever Death-rates in their relation to similar Data for the Borough as a whole; the latter Data being represented in each instance as a constant 100.

Area.	Density of Population.	Attack Rate.		
		Cholera.	Diarrhœa.	Enteric Fever.
Whole borough - -	100	100	100	100
Humber Ward - -	970	140	111	163
N.E. „ - -	590	102	121	55
N.W. „ - -	53	184	106	85
S. „ - -	30	22	97	75
S.W. „ - -	244	87	79	132
Wellow „ - -	104	44	42	49

This table fails to afford indication of direct relation between recorded density of population and incidence of cholera, diarrhœa, and enteric fever. Thus the North-West Ward, with a less dense population than almost any ward, had relatively even more disease of the nature of cholera than the Humber Ward with the densest population of all: and this notwithstanding that the latter ward suffered more enteric fever than any other. On the other hand the North-East Ward, which is second only to the Humber Ward in density of population, had less enteric fever than almost any ward, though it suffered more than its share of diarrhœa and of cholera. The maps annexed to this report, indeed, suffice to show that the figures of Table VII. with respect to density of population are of little worth. These maps indicate that the Grimsby Wards are not equally built over; that for instance the North-West Ward with few persons per total average is nevertheless in part densely built on, and that this closely built section of the particular ward suffered in some respects far more, in others fully as much, as any part of Grimsby, from the maladies which are in question.

Cleethorpe-with-Thrunscoe.

As has been already said the data for Cleethorpes are limited in the main to the deaths referred to the maladies under investigation. These deaths were too few in number for any inferences to be drawn from them as to localisation of one or another disease in the village. The deaths in question, as plotted on the map of the Grimsby and Cleethorpes districts which is appended to this report, appear to have been indifferently distributed throughout the place.

VI.—SOURCE OF THE CHOLERA.

Grimsby.

I have previously mentioned that the S.S. "Dania," which arrived off Grimsby on August 2nd, had on board an engineer sick with cholera. This patient died the following night on board the Port hospital ship, the corpse being landed on August 4th and forthwith buried.

The *first* death on shore, from what was in all probability true cholera, occurred at 59, Trinity Street, Humber Ward, the patient being a man named F——, aged 49. He had been out of regular employment for the six months previously, and had obtained work at odd times at the docks, usually in assisting to unload timber ships. The week before his death the weather had been hot and he had been working hard. The night before his illness he ate a supper of cockles, and was attacked in the early morning of the following day, August 10th, with vomiting and diarrhœa and died 40 hours after seizure. His wife had been "ill" for some weeks previously, and on the death of her husband she removed to another portion of the town, where she died two days later, her death being attributed to "syncope." On inquiry it was found that there was no suspicion of cholera in the case of the wife. Although minute investigations were made as to this man's antecedents and movements prior to his death, nothing beyond that stated above could be found bearing on the case. The death of both man and wife, with the lapse of time since their deaths occurred, made the inquiry a difficult one.

The *second* fatal case of similar sort was that of the woman who died August 15th at 28, Harrington Street, after an illness of eight hours. This case was probably true cholera. Harrington Street is, it will be remembered, in that portion of the Cleethorpe-with-Thrunscoe Urban Sanitary District which adjoins the New Clee part of Grimsby. It faces and runs parallel with the river. This woman had, like the man above referred to, partaken of cockles for supper on the night before her death. This is the Cleethorpes case which has been referred to as etiologically belonging to Grimsby.

The *third* fatal case was G. R., aged 16, of 92, Park Street, Humber Ward, a boundary street between the Great Grimsby and the Cleethorpe-with-Thrunscoe Urban Sanitary Districts. He came home from his work at the Ice House near the docks on August 18th, about 10 p.m., feeling ill. About midnight he was taken with diarrhœa and cramps; he became collapsed, and died at noon on August 19th. His death was registered as due to diarrhœa; but the clinical symptoms, and the rapid course of his illness to a fatal conclusion, seem to point to cholera as the cause of death.

The *fourth* fatal case, W. P., aged 13, of 106, Grafton Street, Humber Ward, was taken with choleraic symptoms, and died on August 20th, before medical assistance arrived. He died within 12 hours of his seizure. This death is, like that of G. R., certified as due to "diarrhœa"; but it was no doubt true cholera. The family have removed from Grimsby, and no details could be obtained.

Fifth fatal case.—On August 20th, the death from "English Cholera" occurred of a man named H———n at the back of 44, Trinity Street, Humber Ward. This man was a master block-maker

and had been employed at the Fish Docks. His death took place after an illness of 24 hours, during which time he received medical attendance at the hands of Mr. C. Byron Turner. This gentleman had, at the date of my visit to Grimsby, no hesitation in saying that the death had been due to true cholera.

Sixth fatal case.—Also on August 20th, a woman named H—t, aged 23, who resided at 136, Rutland Street, Humber Ward, died of what was probably true cholera after 28 hours' illness.

After August 20th cholera cases began more rapidly to increase in number, and by the second week of September had affected all the wards of the town.

Although minute inquiry was made into all the other ascertained cases (9) occurring prior to August 30th, no definite information tending to throw light on the source of the cholera was discovered. There were, however, some conditions in common as regards certain cases. Several had partaken of cockles shortly before attack, and others were employed in or about the docks. Moreover, the earlier deaths were, as has been indicated, limited to the Humber Ward in and around Trinity Square, inclusive of Harrington Street, in the Cleethorpe-with-Thrunscoe Urban Sanitary District. This locality, as will be seen from the map, is close to the docks, sea shore, outfall of the sewer, and the cockle beds. With exception however of this condition of locality, nothing was shared in common by the earliest known cases. I next sought to ascertain whether persons other than those above enumerated had not been attacked by sickness bearing a suspicious resemblance to cholera, at such time and in such circumstances as to constitute connecting links between the fatal cases I have enumerated and between these and antecedent cholera. But I could not discover any such cases. This negative result of inquiry with a view of definitely ascertaining how cholera was introduced into Grimsby is to be regretted, but, as in the case of Hull, is not altogether matter for surprise. Cholera, be it remembered, was in 1892 severely epidemic in Hamburg, with which town, as with other continental towns which were also attacked, Grimsby is in daily communication. In that year (1892) three persons suffering from choleraic diarrhœa and one suffering from diarrhœa of a suspicious character are known to have arrived at Grimsby from Hamburg. All four were removed to the hospital ship "Bradford," where three recovered and one died, the corpse being buried with due precautions in the borough cemetery. The ships which brought these people were disinfected, and infected articles as far as possible destroyed. The two first cases developed on board the S.S. "Talavera" on August 28th, the vessel having arrived from Hamburg on 24th, and being in dock at the time the patients were seized with the disease.

So, too, in 1893 cholera is known to have been recrudescent on the Continent antecedent to its appearance in Grimsby; and a case was brought there from Antwerp in early August. Thus, on August 2nd, the S.S. "Dania" arrived from Antwerp, the engineer of which vessel died and was buried as previously stated. But I could obtain no evidence whatever that subsequent cases of cholera in Grimsby had been related directly or indirectly to infection brought by the "Dania." Locally, indeed, it was considered more probable that cholera had been introduced in one or other of the following ways:—

S.S. "Huddersfield."—It was thought at Grimsby that the disease might have been introduced into the place by the S.S. "Huddersfield," belonging to the Manchester, Sheffield, and Lincolnshire Railway

Company, which trades regularly between Grimsby and Antwerp, sailing from Grimsby on Saturdays, and returning on Thursdays. I allude to this case at length, for the reason that locally much importance is attached to it, a great deal of which would appear to vanish when the facts are known.

This steamer arrived at Grimsby from Antwerp on August 3rd, 1893, and left at 10 minutes after midnight of August 5th and reached Antwerp at 10.45 p.m. on Sunday, August 6th. The stewardess was attacked about mid-day on August 6th with vomiting and diarrhœa, about 12 hours after leaving Grimsby, and 10¾ hours before arrival at Antwerp. On arrival at Antwerp the captain sent for a medical man, who attended the stewardess on board the vessel. When the ship was leaving Antwerp on August 9th, this doctor wrote a certificate to the following effect:—

"Cette personne est atteinte d'un embarras gastro-intestinal ne presentant aucun caractère contagieux."

The stewardess was also seen by Dr. Simpson, the acting Port Medical Officer of Health, on her return to Grimsby on August 10th, and was not considered by him to be suffering from cholera. At any rate, if the case were one of true cholera, the disease was apparently contracted in this country.

The stewardess lives in Cleethorpes, where her father keeps restaurant-rooms, his customers being chiefly "trippers." Both he and his wife had diarrhœa, and pains in the limbs and vomiting about the time that their daughter was ill. However, they thought little of their symptoms, and had no medical advice.

Further inquiry showed that the stewardess occasionally sent some of her personal linen to be washed at the Grimsby steam laundry. She is positive in her statements that she sent none of her linen to the laundry on her return from Antwerp on August 10th. An entry in the books of the laundry shows, however, that some linen was received from her during the week ending August 12th. This laundry is a large one, and washes for a large number of families in Grimsby; from a sample of the body linen, &c., sent in to be washed it was evident to me that the customers are not confined to the upper classes. The washing of all sheets, pillow-cases, blankets, towels, &c., of the vessels, among them the S.S. "Huddersfield," belonging to the Manchester, Sheffield, and Lincolnshire Railway, is carried on at the laundry. The private effects of some of the crews are also washed at this laundry. Inquiry at the laundry during the early part of September showed that none of their servants had died this year, or had been invalided for sickness.

As to shellfish, in regard of which locally some suspicion attached, it deserves notice that the main sewer is tide locked, and discharges into a culvert or groove in the sand. As the tide rises it causes the sewage to collect in the main sewers, to flow out again as the tide ebbs. Near by this sewer outfall are the cockle beds from which Grimsby people dig their cockles. This place is also the favourite bathing place of the youth of Grimsby.

[Although oysters were not locally suggested as being concerned with the cholera, it should be here stated that there is a large oyster trade with Grimsby, under circumstances that will be referred to later on.]

Importation of Second-hand Furniture.—Enquiries were made in respect to the importation into Grimsby of secondhand furniture from Hamburg. There are only two firms in Grimsby who engage in this trade, and they import articles chiefly consisting of office furniture. The better class of chairs, sofas, carpets, and bedsteads are also brought over. There is a considerable trade of secondhand furniture passing through Grimsby to auction rooms at Sheffield, Manchester, Leeds, and Bradford. As far as could be ascertained the families of the first persons attacked by cholera in Grimsby had not bought any

furniture for a year previous to the outbreak, nor indeed, were they the class of person who could afford to buy such furniture as is here in question.

Trade in Rags.—The rag trade to Grimsby is principally from French ports, notably Dieppe. Hamburg, Antwerp, and Rotterdam, however, also contribute. The rags are packed in bales, and sample bales are opened by the railway company's men as required by the Custom House officers. Therefore all bales are not necessarily opened, a tuck stick being passed through each bale. There were, in September 1893, a few hundred bales lying in the warehouses by the docks at Grimsby. Enquiries tend to show that no officer of H.M. Customs or railway employé was attacked by the prevailing epidemic in Grimsby, nor that anyone employed in the manufactories, to which the rags are transmitted, in Dewsbury or Batley suffered from cholera. The number of bales of rags passing into Grimsby between August 9th—September 1st, 1893, was 4,320 bales.

Immigrant and Transmigrant Traffic.—There is a large immigrant and transmigrant traffic through Grimsby; many of these people came from districts infected with cholera, and had shipped from Esbjerg, Maltho, Gothenburg, Antwerp, Hamburg, and Rotterdam, for Grimsby. The majority does not remain in the country, being booked through for America viâ Liverpool, and a few to South Africa. It is presumed that the remainder stop in England. An idea of the number is furnished by the following figures.

A List of the Number of Immigrants who arrived from Esbjerg, Maltho, Gothenburg, Antwerp, Hamburg, and Rotterdam, at the Customs Port of Grimsby in the first eight Months of 1893—

—	Total.	Transmigrants.	Number presumably remaining in England.
January - - - -	593	408	185
February - - - -	1,367	1,012	355
March - - - -	2,620	1,607	1,013
April - - - -	4,304	4,027	277
May - - - -	3,871	3,535	336
June - - - -	2,784	2,601	183
July - - - -	1,516	1,348	168
August - - - -	1,715	1,612	103
Total -	18,770	16,150	2,620

The immigrants on arrival are for the most part taken to sheds in the docks, there to await the train which takes them away. They leave Grimsby principally by the Dock Station, which is a little distance outside the docks. Occasionally they wander into the town in search of provisions, &c. There was in 1893 no suspicion of illness among any of these people in Grimsby or after they left it.

From a study of the above-mentioned statements it will be seen that the source of the choleraic disease which occurred in Grimsby in 1893 remains far from clear. It may perhaps be inferred that some persons or person, suffering from cholera not recognised as such, had either in 1892 or 1893 arrived in Grimsby, thus conveying the infection to the district; and in that connexion the facts respecting the S.S. "Pere-

grine," which arrived in Harwich from Hamburg in 1892, are of interest. This vessel landed her passengers apparently in good health, yet two of them were attacked by cholera on their arrival in London.

In some such way, either in 1892 or 1893, the infection of cholera may have been introduced into Grimsby.

Cleethorpe-with-Thrunscoe.

From the foregoing facts it must needs be doubtful whether the disease was in 1893 introduced into this place from Grimsby, or whether the infection of the disease had been deposited in the district in 1892.

As has been pointed out, a portion of the district is a direct extension of the town of Grimsby; moreover, the village of Cleethorpes is in daily communication with Grimsby. Many people, too, whose daily work lies in Grimsby have their habitation in the Cleethorpe-with-Thrunscoe district; thus several of the servants of the Manchester, Sheffield, and Lincolnshire Railway employed in the docks, on the railway, or line of continental steamboats, reside in the Cleethorpes district. With reference to the fact that several people in inland towns were attacked with choleraic disease not long after eating oysters at or from Cleethorpes, the description in the addendum to this report on the oyster trade of Grimsby and Cleethorpes will prove of interest.

VII.—MAINTENANCE OF CHOLERA.

Grimsby.

Propagation through Personal Relation with Antecedent Cholera.—In one or two cases personal communication was found to have existed between persons attacked. For instance, between a man W. and his daughter, and a woman P. who nursed them;* all three of whom died. In another instance a father apparently contracted the disease from his son, and died in a few hours—the son recovered. So, too, a woman, H. M., who died on September 1st, had nursed a patient, who died of cholera on September 2nd†. But in the majority of cases communication could not be traced between persons attacked and previously invaded households. It therefore became necessary to consider means by which cholera could have been maintained in Grimsby subsequent to the time at which it is known to have first appeared there; and, as a result, in the absence of any satisfactory explanation of the facts of the cholera, the sanitary circumstances of the borough in many aspects came under review. In this connexion special attention was of course given to the Humber Ward wherein cholera became earliest established.

The conditions involved in the general sanitary circumstances of Grimsby; its sewerage and drainage arrangements, disposal of excreta and refuse, and the water-supply, are as follows:—

General Sanitary Circumstances.—The topography and geology of Grimsby have already been briefly referred to. The subsoil water stands at a level of 18 inches below the surface; thus

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* Table I. A., Nos. 6, 12, and 14.
† „ Nos. 16, 19.

houses with cellars or basements are liable to be very damp. Roadways are generally well paved and scavenged; house yards, court yards, alleys, and passages are for the most part well paved with stone flags, brick, cement, or asphalte, and kept in clean condition. The dwellings of the poorer classes are usually two-storey brick cottages, occupied in each instance by one family only, although there are exceptions. The condition of these dwellings on the whole is fair, although exceptions to the rule are not wanting. The condition of the town compares favourably with certain midland towns, or the old towns of Wales.

Sewerage and Drainage.—Spread of cholera in Grimsby has been referred by certain persons to the system of sewerage. And it must be confessed that the sewerage system as it existed in the summer of 1893 was open to many improvements. The Sanitary Authority are, however, endeavouring to effect alterations, which it is hoped will place the draining and sewering of the town on a better footing. What measure of success their attempts will achieve remains to be seen. The main sewers running under the principal streets are circular, built of brick; the largest are 7 feet 6 inches in diameter. The average fall is 1 in 1,600; the minimum, 1 in 1,800, and the maximum, 1 in 1,200. The tributary sewers are made of glazed earthenware pipes, 12 and 9 inches in diameter, and the fall in nearly every instance is insufficient. Owing to the want of fall these sewers cannot be self-cleansing. There are two outfalls to the sewers, one at Pyewipe, and the other into a channel in the sand outside the Fish Dock. The former receives the drainage from the south and south-west wards of the town, and the drainage from the "Heycroft drain," an open sewer, into which many drains enter. The Fish Dock outfall receives, in addition to the town drainage, a small rivulet called the East March Drain, which brings in the drainage from a considerable agricultural district. The sewer outfalls are guarded by "sling gates," which are supposed to open during the ebb and shut during the flow of the tide. During a great portion of each 24 hours the sewage remains ponded in the sewers. The system of sewerage receives the storm water, which at times would help to swell the volume of sewerage pent up in the sewers. In fact, it has been stated that the main sewer is sometimes absolutely full from the outfall half-way up the town.

Only the kitchen or slop-water passes into the sewers in the greater portion of the district. As a rule house drains commence in the back yards and not inside or under the houses. These drains join the tributary sewer at the bottom of the yard, and the tributary sewer joins the sewer of the road which runs at right angles to it. House drains are not disconnected from the sewers.

The sewers are ventilated by man holes in the centre of the streets, placed at intervals of one to two hundred yards. There are no supplementary ventilating shafts provided, and, as many of the manholes have been closed on account of the smell arising from them, the sewers are insufficiently ventilated.

Only about 3 per cent. of the road storm-water gullies are properly trapped from the sewers. The rain-water pipes in Grimsby generally run directly into the house or yard drain with no intervening trap or gully. Thus they act as ventilators for the sewers. The joints of these rain spouts are often loose, and allow sewer air to escape near the level of the windows. When there are sinks inside the dwellings, the sink pipes empty, as a rule, over gullies outside the houses.

To all these defects is added the disadvantage of the *Grimsby cesspool.* These so-called "cesspools," which, to the number of about 8,000, are to be found in Grimsby, are not cesspools in the ordinary acceptance of the term, but rather "catch-pits" on the line of the house drain. They are, in fact, receivers placed on the course of the drain, to catch any solid matter and to prevent it passing to the sewers, which, owing to their want of fall, might readily become silted up if much solid matter found its way into them. According to a recent report of the "Cesspools Committee of the Town Council," some 4,500 of the "cesspools" are built of brick, and have a capacity of from 10 to 60 gallons, and some 3,500 are "Sharp's Gullies, No. 3," or sanitary pipes placed on their ends. In the old town alongside the railway, in the neighbourhood of Freeman and Hainton Streets, as also in the Humber Ward, cesspools are especially numerous.

These cesspools or catch-pits are as a rule found in the yards of the houses, and they are fitted above with an iron top trap. This often fits imperfectly, and the sewer air can escape into the yard, frequently in proximity to the back windows and doors. Moreover, the joints of the bricks forming the cesspools are often loose, and allow the fluid contents to escape into the soil around and sometimes into the foundations of the house. Owing to sewage being backed up in the sewers for a large part of the 24 hours, sewer air, and sometimes even the sewage, is driven out of these "cesspools."

In some instances, as I ascertained, choleraic stools had been emptied into these cesspools, and it is extremely probable that in many instances bowel discharges, unrecognised as being infective, although quite possibly of an infective character, were passed into the sewers without previous disinfection. In this way cholera may have been helped to establish itself in Grimsby.

It is true that in instances where emptying of choleraic evacuations into "cesspools" came to the knowledge of the Sanitary Authority, the cesspools were opened, cleaned out, and disinfected, and the drain flushed by water from a hose. Special attention was given to this in the Humber Ward as soon as it was ascertained that cholera was becoming established in that neighbourhood. But it must not be forgotten that in many instances these cesspools are in a leaky condition, that they communicate with the sewers, and that the infective material may have leaked into the soil or have found its way into the sewer before the disinfectant and flushing measures were applied. In such cases imperfect means of ventilation, deficient fall, and absence of systematic flushing of sewers would then help to foster within them the cholera microbe. So far as could be ascertained, however, the cholera in Grimsby did not affect any particular line of sewers.

Excrement and Refuse disposal.—It is only in the better class of house that there are water-closets inside the dwelling. Practically there are but few water-closets in Grimsby. In by far the greatest portion of the town "the closet" is placed outside the houses. Boxes or pails are placed under the closet seats, and are removed once a week by a contractor, who disposes of their contents in agricultural districts for manure, or conveys the excreta to the depôt beyond the West Marsh.

The "boxes" are wooden receptacles; when new they are tarred halfway up the inside, and they are of various sizes. A common size is 30 inches long by 18 inches wide, and 16 inches deep, though there are many larger. The boxes, besides receiving the human excrement, solid and liquid, are also used as receptacles for household refuse. There are only a few houses in the district where separate receptacles

are provided for refuse, namely, the houses furnished with water-closets. In the privy wall there is an aperture (not always kept closed) through which the box is drawn out by the night-soil men, and generally matters are so arranged that the box is removed through a separate entrance without passing through the house. There are only 30 houses where this latter procedure is necessary. In many instances there is another aperture high up in the privy wall made by leaving out a brick or two. This aperture is for ventilation, the result being that the wind creates a draught and occasionally blows the lighter contents of the boxes about. As in many cases the privies are close to the kitchen windows, this becomes a matter of importance.

The night-soil men work between 10 p.m. and 8 a.m. On their round they draw out the "box" and empty its contents into a scuttle, and the scuttle is carried to the night-soil cart into which its contents are emptied. Thus, when the "box" is emptied into the scuttle and again when the scuttle is emptied into the cart, a certain amount of débris may be set free to contaminate the atmosphere. The contents of these boxes is not always dry. It frequently happens that the boxes are full to overflowing with semi-fluid matters, and the night-soil man, notwithstanding that there are fines and penalties against the contractor for "slopping," naturally spills some of the contents of the box in attempting to empty the contents into the scuttle. Again the boxes very often leak, and allow the fluid contents to ooze out to the space beneath the closet seat. Also the boxes naturally become sodden with organic filth, and a sticky mass tends to collect at the bottom and sides, which are seldom thoroughly cleaned; added to which the night-soil men are under the additional disadvantage of working largely under cover of darkness.

Whenever these boxes were known or suspected to be infected with choleraic discharges, the Sanitary Authority caused them to be burnt and replaced by galvanised iron pails. Nevertheless, it must be evident that in many cases bowel evacuations, which were not considered choleraic in character, but which may have been none the less "infective," were passed into the boxes, many of which remained in use; and that possibly contamination in this way of the premises of houses and of the atmosphere may have helped to disseminate cholera.

Milk Supply.—No information was obtained which tended to place any particular supply of milk under suspicion, or of its having acted in any way in the transmission of the disease.

Water Supply.—The supply of Grimsby is derived from two sources—from the Great Grimsby Waterworks Company, and from private wells sunk in the town.

The Great Grimsby Waterworks Company supply water for domestic purposes to the greater portion of the Urban Sanitary District.

The water is obtained from about 14 artesian wells sunk in the chalk; four of them at Little Coates, and the other ten at Beconthorpe Cleethorpes. The Little Coates wells are 21, the others 6 inches diameter. Both sets of wells are constructed of iron cylinders, covered in with brickwork and cement, having bore holes varying in depth between 80–400 feet.

The water is pumped directly into the mains, there being no reservoir. The supply is constant and is not turned off, except for such purposes as necessary repairs to the mains. The mains are coated with

Dr. Angus Smith's preparation. The following is a copy of an analysis of the water made four years ago by Mr. Baynes, borough analyst:—

"Sample of water taken from Grimsby Water Company's works on July 19th, 1889:—

	Grains per gallon.
Carbonate of lime	14·41
Sulphate ,,	1·71
,, magnesia	·83
Chloride of sodium	1·97
Nitrate of lime	·98
Alkalies	·10
Total solid residue	20·00

	Parts per million.
Free ammonia	·016
Albuminoid ammonia	·028

	Degrees.
Temporary hardness	13·95
Permanent ,,	2·80
Total	16·75

The above represents a high degree of purity.

(Signed) James Baynes."

From this analysis it will be seen that chemically the water was in 1889 good water, but as is usual in waters derived from the Chalk, a trifle hard. It falls on the Lincolnshire wolds, and is tapped by the wells at some considerable distance from the town. Hence it should be exceptionally free from risk of pollution; and it was in no case under suspicion.

But as has been implied, some houses do not have the company's water, but are supplied by wells on their own premises.

Of these private wells, there are 162 in the borough, and they supply some 1,166 houses out of a total of 10,631 inhabited houses.

All these wells are carried through the Boulder Clay to the Chalk, and range from 80 to 140 feet in depth. I am informed by the Sanitary Authority there are no such things as surface wells in the district. The Grimsby well is usually of the following construction; the well is lined to a depth of about 7 feet with glazed earthenware tubes 18 inches in diameter, with cemented socket joints; the lowermost tube rests on a flagstone, from a hole in the centre of which a bore hole lined with an iron tube is carried down to tap the springs in the chalk. Such a well properly made yields good water, but it sometimes happens that, through defective workmanship or shifting of the ground, the joints crack, allowing soil water polluted from leaking "cesspools" possibly to enter and contaminate the well. I saw samples of the various "pump" waters at the Town Hall which had been collected by the Inspector of Nuisances, and several of these were discoloured and had deposited sediment. No record of chemical analysis of any of these well waters was available. A map showing the position of these wells is annexed.

As far as could be ascertained at the time, the attacks of choleraic illness occurred independently of any source of water supply. The

earlier cases of the outbreak occurred in dwellings served with the company's water, and although it was impossible to eliminate the chance that these persons partook sometimes of well water, still the water ordinarily consumed by them would undoubtedly be derived from the water delivered to the taps near their dwellings; and although at a later period persons were attacked who drank well water, yet no particular well was ever brought under suspicion. Of the 127 cases of disease of the nature of cholera occurring in Grimsby, 13 drank well water, and of these two died.

Cleethorpe-with-Thrunscoe.

Here personal communication, direct or indirect, appears to have played but a small part in the propagation of the disease; moreover, no adequate explanation could be found for its maintenance after it first made its appearance in the district.

General Sanitary circumstances.—The district of the Cleethorpe-with-Thrunscoe Urban Sanitary Authority covers an area of 1,196 acres. The geology of the district has been already alluded to.

Sewerage and Drainage.—All the occupied roads appear to be sewered in Cleethorpe-with-Thrunscoe; the place being provided with two separate sewer systems. The *southern half* of the village was sewered in 1870. The sewage, after passing through two brick settling tanks (15 feet by 7 feet 6 inches), is discharged without further treatment into the Humberstone Beck at a point where it is tidal.* This Beck, which is crossed by a footpath, was in May 1893 in a very foul condition, although it had been cleaned out two months previously. The sewers of this system are circular glazed "sanitary" socketted pipes with clay joints. The main sewer is 18 inches in diameter and the branches 12 inches and 9 inches. This sewer has near its outlet a fall of only 1 in 1,540; but most of the branches have a gradient of 1 in about 400. The sewers are deficiently ventilated, being provided only by a few open gratings at the dead ends. To some extent they are ventilated up the down spouts of the houses. There is no provision for permanent flushing apparatus on this system. It is flushed with water from the company's mains three times a year.

The *northern half* of the village was sewered in 1888 to an outfall in the sea below the low-water mark at the north end of the district. This is known as the Beaconthorpe outfall. These sewers are circular stoneware socketted pipes, of 18 inches, 21 inches, 24 inches, and 30 inches diameter; branch sewers are 12 inches and 9 inches. The gradients are 1 in 1,187 to 1 in 1,215 for the main sewers, and 1 in 400 to 500 for the branches. The sewers are ventilated by open gratings every 100 yards. There is one flushing tank at the head of the system.

House Drainage.—Where closets are in use the closet drains go direct into the sewers without any disconnexion or fresh air inlet. There are "cesspools" on the drains as at Grimsby. The water-closet soil pipes were found to be 4-inch iron pipes, ventilated only by 2-inch pipes.

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* The neap tides do not get up the Beck to the point in question.

When the Board's Inspector, Mr. T. W. Thompson, inspected the district at the end of the spring of 1893, he found many of the soil pipe joints defective. On discharging water down the closet of a house in Balmoral Terrace it oozed through a defective joint in the soil pipes close to a window. As these soil pipes communicate directly with the drains and sewers they obviously ventilate the sewers close to the windows of the dwellings. The waste pipes from sinks in houses seem to discharge mostly over gullies outside the house walls. The majority of the houses, however, have no sinks inside them. In such cases there are sinks in the yards. Some of these have large 9-inch stoneware gullies usually surmounted with "bell" or "lip" traps, but not a few of them have square brick catchpits (18 inches square) and trapped only by bell or lip traps, which in some instances were broken.

Disposal and Removal of Excreta and Refuse.—With the exception of some houses which have water-closets, almost all the houses are provided with privies having moveable receptacles. These receptacles consist of wooden boxes varying from 2 to 3 feet in length, and about 18 inches in breadth. In a few instances, however, privies with fixed receptacles were found. Sometimes these fixed receptacles were of considerable depth. Some houses are provided with ash-pits, but most of them use the privies for refuse disposal, hence the large size of the wooden boxes. Ashpits are generally uncovered, and often of defective character. The Sanitary Authority contract for the removal of excrement and refuse and the cleaning of "cesspools" The existing contract is for three years, two of which have elapsed. It requires the removal of excrement and house refuse once in seven days for 10 months in the year, and bi-weekly in July and August. The "cesspools" are to be cleaned once every month. The scavenging seems to be done satisfactorily except in a few isolated instances. The contractor takes the excrement and refuse to a depôt provided by the Urban Sanitary Authority in a field off the Humberstone Road. The depôt comprises half an acre of land, and is situated about 150 yards from the road, 500 yards from the village, and 200 yards from a farmhouse.

Water Supply.—The Great Grimsby Water Works Company's mains are laid in the district. The majority of the houses in the Cleethorpe-with-Thrunscoe Urban Sanitary District are now supplied with this water, which is laid on to the larger houses, and to stand pipes in the yards of the smaller houses.

There are about ten private wells still in the district. The wells are in some cases sunk in proximity to old drains, and some of the wells are dry steined.

VIII.—SANITARY ADMINISTRATION.

Grimsby.

The sanitary administration of the Urban Sanitary District of Great Grimsby is vested in the Corporation as the Urban Sanitary Authority. The powers of the Corporation are delegated to a Sanitary Committee, of which Mr. Alderman Jacob Marshall is Chairman. The administration is carried out by the Medical Officer of Health, who is in private practice, along with an Inspector of Nuisances and an Assistant Inspector of Nuisances.

The Inspector of Nuisances is responsible to the Sanitary Committee, but acts under the Medical Officer of Health in matters connected with

infectious disease. The Assistant Inspector of Nuisances is also responsible to the Sanitary Committee, acting, so far as his own district is concerned, independently of his colleague, but he acts under his senior's orders when required to do so. The drain flushers, distributors of disinfectants, whitewashers, &c., are borrowed as required from the Highways Department, no regular staff being employed for these purposes.

The Sanitary Authority disinfect free of charge houses that have been invaded by infectious disease, and also articles that have been exposed to infection.

Cholera Arrangements in 1892.

On the outbreak of cholera at Hamburg in August 1892, the Sanitary Authority adopted, at instance of Local Government Board, special measures of prevention against this disease.

They carried on a system of medical inspection of passengers and crews of vessels coming foreign, and for this purpose kept their hospital ship "Bradford" moored outside Grimsby Harbour, and the steam-tug "Chapman" in attendance to carry their Deputy Port Medical Officer of Health, Dr. Simpson, to and from the shipping. Dr. Simpson lived on board the hospital ship, and was thus able to meet the incoming vessels at each tide. A Custom House officer also dwelt on board the "Bradford" and visited the vessels with the Deputy Port Medical Officer of Health. This inspection of shipping was continued until December 1892, when the hospital ship was towed into dock.

On shore the Sanitary Authority divided the town into districts for special scavenging purposes, and caused placards to be posted and notices to be left at every house recommending that in all cases of diarrhœa medical attendance should at once be sought. These notices treated briefly of precautions against cholera in matters of food and drink, and stated that the Sanitary Authority had made arrangements with the medical men of the town to give advice to, and prescribe for, any person applying to them, attacked with diarrhœa, and had authorised druggists to supply disinfectants at the cost of the Sanitary Authority. The Sanitary Authority also arranged for a supply of hospital tents from London, and for the speedy interment in quicklime of the corpses of persons dying of cholera. One or two bodies were actually thus interred, although there was no evidence forthcoming as to the illness causing death having been in any way due to cholera.

During the winter, 1892–93, Mr. Alderman J. K. Marshall, the Chairman of the Sanitary Committee, made endeavours to have a hospital for isolation of infectious diseases built, the hospital which had been used in the small-pox epidemic being considered unsuitable for the treatment of infectious diseases. But the town council did not support the Sanitary Committee in this matter, thinking probably, that as the district had escaped cholera in 1892, it would escape also in 1893, and preferred to consider plans of improving the appearance of the town, as, for instance, by the construction of boulevards, and like works.

Cholera Arrangements in 1893.

During the spring and early summer of 1893 Mr. Alderman J. K. Marshall advocated the adoption of similar means to those employed in 1892. Again, however, the Sanitary Authority did not, as a whole, give its support to Mr. Marshall. On shore the hospital remained unbuilt, the hospital ship remained in dock, and medical inspection of the passengers and crews of ships arriving in Grimsby from places on the Continent, where cholera was occurring, was not resumed.

Thus matters stood until the S.S. "Dania" arrived at Grimsby with a case suspiciously like cholera on board. The hospital ship "Bradford" was then, on the following day, towed out of dock and moored off Grimsby, having been equipped with a crew and having Dr. Simpson on board. The sick man was removed to her and died on board. Medical inspection of incoming foreign vessels was commenced the following day, August 4th, in the same way in which it had been carried out in 1892.

On occurrence of a death on shore, attributed to "cholera nostras" on August 11th, notices and placards, similar to those issued in 1892, were left at the houses and posted in conspicuous places, and on August 25th the Sanitary Authority of Grimsby applied, by circular note, to the medical men of the place requesting them to report cases of choleraic character. As this notice did not produce the desired effect, on August 31st the Sanitary Authority sent round a second circular stating that "the usual fee of 2*s.* 6*d.* will be paid for each notification," and that a fee of 5*s.* per case would be paid to the medical men on giving advice and a prescription to persons applying to them attacked by diarrhœa, and on September 1st the notification and fee was extended to "diarrhœa."*

It is manifest that the Sanitary Authority regarded the outbreak from the very first as of grave import. The sick were isolated as far as practicable without removing them to hospital, their premises were disinfected, and the dead were speedily buried in quicklime. An attempt was also made, as regards one of the earlier cases antecedent to my visit, to determine the exact nature of the disease by transmitting to Dr. Hime, of Bradford, a sample of a stool for bacteriological examination. It was reported, however, that the quantity sent was insufficient for the purpose. On the 21st of August Dr. Newby, Medical Officer of Health for the Urban Sanitary Districts of Grimsby and Cleethorpe-with-Thrunscoe, wrote for the first time to the Local Government Board on the subject of choleraic disease in his districts. He informed the Board that three deaths had been registered in the districts under his charge as due to "cholera nostras"; that these deaths occurred on the 11th, 15th, and 20th respectively; and that the medical attendant had stated in regard of one case that "she had every symptom of cholera (Asiatic)," though he certified the death as from "cholera nostras." In view of these facts and of the occurrence at Hull of a definite case of cholera, I was, as I have said, ordered by the Board to visit Grimsby on the 29th August, and on the 31st of the month Dr. Klein stated, in regard of material submitted by me to him from a fatal case at Grimsby, that the disease was, in his opinion, Asiatic cholera. From that date the Sanitary Authority lost no time in making further arrangements to grapple with the disease.

The Local Government Board sanctioned on September 1st the exercise of the powers conferred upon Sanitary Authorities by section 133, Public Health Act, 1875, by the Great Grimsby Urban Sanitary Authority and the Grimsby Port Sanitary Authority, and a cholera sub-committee was appointed, composed of the Mayor (Mr. Doughty), Aldermen J. K. Marshall (Chairman) and Mudd, and Councillors Mundahl and Brown.

The project of having hospital tents from London, which had formerly been entertained by the Sanitary Authority, was now given up, and a staff of workmen was employed day and night altering the old fever hospital to render it suitable for the reception of cholera cases.

* The fee for notification was withdrawn on September 11th, although a few notifications were received up till the morning of September 13th.

The hospital was placed under the medical charge of Mr. H. J. M. Watts, and the nursing arrangements were entrusted to Miss Jackson, who had a staff of nurses working under her orders. There was already on the hospital premises a Washington Lyons steam disinfecting apparatus.

Dr. Bruce was appointed to devote his whole time to the duty of Assistant Medical Officer of Health, and to personally superintend all the work undertaken with a view to suppression of the cholera.

Epidemic Regulations were issued by the Local Government Board for Grimsby Urban Sanitary District, and Cleethorpe-with-Thrunscoe Urban Sanitary District, and Grimsby Port Sanitary District on September 1st, and on September 6th Supplementary Regulations were issued rendering choleraic diarrhœa notifiable whether the Infectious Disease (Notification) Act, 1889, was in force or not.

The Cholera Sub-Committee, on September 6th, requested the medical practitioners of the town to meet them at the Town Hall, and most of the medical men attended. The Chairman explained the Epidemic Regulations, a copy of which had been sent to each medical man, and asked them to appoint six of their number to act as medical visitors. This they refused to do, and the meeting terminated. The sub-committee then procured the services of seven medical men, all strangers to Grimsby, at a salary of seven guineas a week each, with board and lodging, to act as medical visitors, six being assigned districts in the town and one being given charge of the docks.

The "boxes" for excreta were at once removed from the premises of houses in which cases of choleraic disease were notified; such boxes were burnt and metal pails were substituted. The contents of these pails were disinfected, taken to the night soil depôt, beyond the West Marsh, on the remote side of the railway line, just within the borough boundary, and there mixed with sawdust and petroleum and burnt. Later on this procedure was carried out in the hospital grounds in a destructor specially set up for the purpose. In some cases the excreta had passed into "cesspools" before the Sanitary Authority became aware of the illness, and as soon as this became known such "cesspools" were cleaned out and disinfected.

The town was divided into districts for scavenging purposes, and a foreman with a staff of scavengers appointed to each.

Arrangements were made with the Grimsby Nursing Institute and with the Stoke Nursing Institute for supplying trained nurses for the sick at their own houses.

All the dead were wrapped in sheets, soaked in carbolic acid, and the Inspector of Nuisances saw each body placed in the coffin and taken to the cemetery there to be buried in chloride of lime; he also stayed at the cemetery until the grave was filled in.

All persons were turned out of any house where a death from disease of the nature of cholera had taken place, and the Sanitary Authority took possession thereof until the house had been disinfected by washing with disinfectants and lime washing. All bedding, clothes, &c., that by any chance had become contaminated were soaked in a disinfectant and taken away and burnt.

A house of refuge was provided by the Sanitary Authority for persons who, for the purpose of disinfection of their premises, were turned out of their houses.

A house-to-house inspection was carried out by the Medical Visitors, who also in addition to treating the sick in emergency made special reports on the sanitary condition of the houses and on their districts generally.

Dr. Rogers, the Medical Visitor placed in charge of the docks, attended each tide, *i.e.*, every twelve hours, and examined the crews of the coasting vessels and fishing smacks on their entrance into dock.

The first fishing smack which was reported as having cholera on board was the "Speculator." She left Grimsby, August 29th, with a crew of four hands, and not having touched at any port returned to Grimsby on September 1st. One of the deck hands, W. B., aged 52, who resided when at home at 47, Guildford Street, New Clee, Grimsby, had been attacked with choleraic symptoms on the day of sailing. He was recovering when he was transferred to the hospital ship "Bradford." From the same smack W. L., aged 57, was also removed to the Hospital Ship on September 1st. He usually lived entirely on the vessel and had been attacked on August 30th. He also recovered. A few other cases were removed to the Hospital Ship, and certain cases of choleraic illness in the town were traced to the smacks, but their number was small. There is, however, little doubt that diarrhœa existed among the crews of these smacks, though but little in comparison with the diarrhœa in the town.

The work of the Cholera Sub-Committee and of the officers of the Sanitary Authority was no sinecure. There was dissatisfaction among the medical men of the town, many of whom failed to realize the necessity for the action taken by the Sanitary Authority in instructing the Medical Officer of Health to visit notified cases, with a view to decide under Article 12 of the Epidemic Regulations, on the necessity or otherwise of such cases being taken to the cholera hospital. And one of them wrote to the Medical Officer of Health to the effect that under these circumstances he must decline, with probably (he said) the majority of the practitioners in Grimsby, to notify any further cases: stating inter alia that he considered that in these days of competition he could not afford to introduce whomsoever the Sanitary Authority might think fit to his private patients. That such inspection of patients was rightly undertaken by the Sanitary Authority became sufficiently evident. There were medical practitioners in Grimsby employing unqualified assistants, and, in one instance, I was informed that one of these assistants had diagnosed "suppressed menstruation," whereas, on seeing the case, the Medical Officer of Health, the Assistant Medical Officer of Health, and myself, and afterwards Mr. Watts, the Medical Officer in charge of the hospital, considered that the case was one of well-marked typhoid fever. Again, it was judged necessary to inspect each case on its being notified, since a particular case that had been notified as mere "diarrhœa" was found a few hours later moribund from cholera. And on a particular day three cases of "diarrhœa" which were notified, were deemed by the Sanitary Authority to be "choleraic," and the patients removed to the hospital. In justice, however, to the medical men of Grimsby as a whole, I must state that at their hands I received nothing but courtesy, and everything that they could do was done to help me in my inquiry. Again, there were letters written to the local press by members of the Sanitary Authority, in which the action of the Cholera Sub-Committee was severely criticised.

All these things seriously handicapped the efforts of the Cholera Sub-Committee, who are deserving of commendation for the efficient way they acted in the emergency; and it is essentially due to them, and to the energetic action of their officers, that cholera did not obtain a firmer footing in the town.

I consider, however, that the Sanitary Authority made a serious mistake in not insisting on the ship "Elizabeth" being removed from the dock when she was certified by the Port Medical Officer of Health

to be infected with cholera. And this error was followed by manifestly weak action as regards the "Infective Diarrhœa" which was dealt with on board the ships in the Alexandra and Union Docks. None of these ships were ordered out of dock. They were merely washed down with carbolic acid solution and the closets cleaned out, they were not fumigated. The excrement of persons sick on board them was in nearly every case passed into the docks.

Among the lowest classes great ignorance and indifference were displayed. Many people were unable to read the notice left at their houses by the Sanitary Authority. Many who could read did not comprehend the meaning of the word "diarrhœa" and took no trouble to find out.

At a common lodging-house a man who had symptoms of cholera was found in a double bed. His bed companion, an elderly man, seemed utterly indifferent to the fact that his fellow lodger was acutely ill.

At one time, however, something like panic seized upon a few of the inhabitants. In a particular instance, on a death occurring, the Sanitary Authority had to break into the house to obtain possession of the body for burial, the occupants having locked up the house and made a hurried departure to Sheffield.

The undertakers' men refused for some time to deliver the coffins inside the invaded houses or to place the dead bodies in the coffins. A climax was reached when a coachman refused to drive the hearse. In these circumstances the Assistant Medical Officer of Health and the Inspector of Nuisances went by night and removed the dead in the ambulance to the hospital mortuary to await burial while the houses were disinfected.

There would appear to be but little doubt that the Sanitary Authority, to say the least, suspected that they were dealing with cholera at the very beginning of the epidemic, and that the matter was not made public for fear of affecting the trade of the town. The result was that the hospital was not prepared, the patients were not moved to hospital, and for ten days no sufficient action was undertaken in limiting the spread of the disease. If the first suspected cases could have been taken into the hospital it is possible that Grimsby might have been secured against further cholera. And the influence of this fear of losing trade could be traced throughout the epidemic. There were many persons in the town who would have been pleased to have hushed the matter up, and in their wisdom—wisdom which takes no heed for the morrow—would have been content to keep the fact of cholera being in Grimsby a fact known only to themselves. Regard for advantage in business was allowed to dictate what should be done at the moment; Grimsby itself, and the country at large to a less extent, being the sufferers.

Cleethorpe-with-Thrunscoe.

The Sanitary Authority consists of a chairman and eleven members. The administration devolves upon the Medical Officer of Health (Dr. Newby), an Inspector of Nuisances, and the Surveyor, who is also the clerk to the authority.

There is no accommodation for the isolation of infectious disease in the district, and when the choleraic disease appeared in the district the Sanitary Authority were quite unprepared to meet it.

In 1892, the Cleethorpe-with-Thrunscoe Urban Sanitary Authority met the Great Grimsby Urban Sanitary Authority in conference, and it was arranged that, when a hospital for infectious disease was built at

Grimsby the Cleethorpe-with-Thrunscoe Authority should combine with the Great Grimsby Authority in the undertaking. Nothing more was, however, done in the matter, and, as already stated, the advent of cholera found the Cleethorpe-with-Thrunscoe Urban Sanitary Authority unprepared.

On it becoming known that a death from undoubted cholera had taken place in Grimsby, the Urban Sanitary Authority of Cleethorpe-with-Thrunscoe sent a deputation to the Sanitary Authority of Grimsby. I attended the meeting. It was arranged that the Cleethorpe-with-Thrunscoe Authority should send their cholera sick, when such cases were fit for removal, to the hospital at Grimsby, and that they should, as far as possible, adopt similar sanitary precautions to prevent the spread of the disease as were being adopted by the Grimsby Urban Sanitary Authority.

Medical Visitors, a new Inspector of Nuisances, and extra scavengers were appointed, and in other respects, also, the Epidemic Regulations, which were issued to the Cleethorpes Urban Sanitary Authority at the same time that they were issued to the Grimsby Urban and Port Sanitary Authorities, were carried out. Hand bills were issued and placards posted similar to those of the Grimsby Urban Sanitary Authority.

From the foregoing account it may be seen that cholera and choleraic diarrhœa were not prevalent to any great extent in Grimsby or Cleethorpes in 1893. The continued maintenance of disease of the nature of cholera in the former place for some considerable time, and the extensive prevalence there of diarrhœa and typhoid fever, are facts that should seriously engage the attention of the Sanitary Authority. The sewerage systems of both districts are now under revision, and I have directed attention to the defects of the "box" system of excrement and refuse disposal. It is doubtful whether the private wells of Grimsby and of Cleethorpes are free from risk of pollution, and doubtful also whether they have not had some share in the maintenance and spread of choleraic disease. They should be severally examined with a view to ascertaining any possible sources of contamination of their water. The necessity of having proper isolation accommodation ready for immediate use has, I should hope, been sufficiently brought home to the Sanitary Authorities during the summer of 1893.

The necessity for an Assistant Medical Officer of Health at Grimsby during the epidemic, devoting his whole time to the duties of his office, was made evident last year, and it behoves the Sanitary Authority to consider whether whole time service from their Medical Officer of Health should not be arranged for.

The great trade of the town, the fish trade, is one calling for constant care and watchfulness on the part of the Sanitary Authority, and an additional Inspector of Nuisances for the fish docks would be an advantage.

The large number of trippers,* principally from manufacturing towns, who visit Cleethorpes is a constant source of danger in so far as the importation and exportation of infectious disease is concerned, and the absence of the adoption by the Sanitary Authority of that place of the Infectious Disease (Notification) Act, 1889, renders anything like prompt action on the part of their Medical Officer of Health almost an impossibility.

* In the six months May to October 1893, no less than 235,721 excursionists were booked to Grimsby and Cleethorpes by the Manchester, Sheffield, and Lincolnshire Railway alone.

Before closing this report I must express my sense of the kindness and courtesy invariably extended to me and the help which I received during my investigations at Grimsby and Cleethorpes. And I here take the opportunity of thanking the Mayor, Aldermen, and Councillors and the medical practitioners of Grimsby; the members of the Sanitary Authority of Cleethorpe-with-Thrunscoe, and Dr. Pickford of Cleethorpes, Dr. Moody, the coroner; Dr. Leppington, the Registrar; the officers of the Manchester, Sheffield, and Lincolnshire Railway Company; the officers of Her Majesty's Customs, the Managers of the Steam Laundries, and the Manager of the Great Grimsby Waterworks, and several other gentlemen.

But especially I must express my appreciation of the untiring energy of, and of the valuable assistance rendered to me by, Mr. Alderman J. K. Marshall, the Chairman of the Cholera Sub-Committee; as well as of the help afforded me by Drs. Newby, Bruce, and Simpson, the Medical Visitors, and the Inspector of Nuisances. To Mr. Petre, the Borough Surveyor of Grimsby, I am also indebted for much help, as regards maps and diagrams.

ADDENDA.

A. Growth of Grimsby.
B. Docks and General Trade of the Port.
C. Oyster Trade of Cleethorpes and Grimsby.
D. Mussel and Cockle Trade.

A.

The borough of Great Grimsby is of ancient date, its charter having been granted by Edward III. Even in those days Grimsby was interested in the shipping trade, and had to provide a fleet of 10 ships and 171 men for the siege of Calais. Its rise into importance in recent times dates from about the year 1800, when the first dock was constructed, the population in 1801 being only 1,524. The commerce of the town was augmented by the opening up of railway communication in 1848, and by the development of the fishery industry and foreign trade.

Until recently the borough of Great Grimsby contained 1,838 acres, and the population was, at the census of 1861, 11,067; in 1871, 20,244; in 1881, 28,503. Between 1881 and 1891 the boundary of the borough was altered, the New Clee and Wellow Weelsby area being added, and the acreage increased to 2,832 acres. At the census of 1891 Grimsby contained 10,631 inhabited houses, and a population of 51,934 persons. These figures for the corresponding district in 1881 would be: inhabited houses, 7,612; population, 40,010. Thus it may be seen that the district has been increasing rapidly both as regards the number of inhabited houses and the number of the population. This increase is still being maintained. A great portion of the district is distinctly urban. Wages are good, and the inhabitants are as a rule well-to-do. Whole streets in the town have been built by the working classes—each house by the occupier—through the aid of building societies; and as a consequence many houses are exactly alike, each building society having its own model. There does not exist in the town any portion where squalor and filth can be said to be conspicuous. The least clean part of the town is, as might be expected, that portion lying near the fish dock, and where the fish curing is carried on. Here in the driest day in summer the streets and approaches to the docks are muddy, due to the melting of the ice used in the fish trade, the water dropping on to the roads from the boxes of fish.

B.

Docks and General Trade of Grimsby.

The Grimsby Docks were commenced about the year 1800, and have since been improved and extended from time to time. The Royal Dock was opened in 1858, and the Alexandra Dock in 1879. A small dock—the Union Dock—connects the Alexandra and Royal Docks. In the main, the timber trade goes to the Alexandra and Union Docks, the continental traffic to the Royal Dock, and the fish trade to the Fish Docks. The docks are substantially built and are kept in good repair. Means for thoroughly flushing the docks do not exist. The dock gates are opened before high water and closed on the ebbing tide, consequently there is not more than some six feet rise and fall in the waters of the docks. Situated along the sides of the docks are warehouses for storing merchandise. The fish pontoon is of course situated in the Fish Docks. A deposit of sand tends to silt up the entrance to the docks, and requires constant attention on the part of the authorities.

The trade of Grimsby is such that the town is exposed to constant danger when an epidemic disease, such as cholera, exists on the Continent. Six steamers arrive at Grimsby every week from Hamburg, two steamers

a week each from Antwerp, Rotterdam, and Dieppe, and one steamer a week each from Gothenburg, Malmo, and Esbjerg. Boats from the three last-named ports bring immigrants. Occasional steamers come from the French ports. In addition, there are the relations at sea of the Grimsby fishing fleet with the "coopers." "Coopers" are vessels which hail from the Dutch coast, and carry on a contraband trade in spirits, &c., with the fishing fleet. Grimsby is also in constant communication with Hull, both by water and land, and many of the crews of vessels discharging at Hull live at Grimsby or Cleethorpes.

C.

Oyster Trade of Cleethorpes and Grimsby.

It having been stated in several quarters that persons who had partaken of oysters from Grimsby and Cleethorpes had died a short time afterwards with symptoms of Asiatic cholera, I made investigation of the conditions under which the oysters trade of the district is carried on.

The oyster beds are situated off Cleethorpes, and are distant about 1¾ miles from high-water mark. They are partially uncovered only at the very lowest tides. The map of the coast annexed to this report shows the position of these beds. The flowing tide sets directly in at right angles to the coastline, and the ebbing tide runs outwards in the main direction of the waters brought down by the Humber River.

There are at Cleethorpes four dealers in oysters—Messrs. M., O., L., and C. Messrs. M have the largest trade. Their firm possesses oyster beds in America, Ireland, Zeeland, Sutton, Brightlingsea, Cleethorpes, &c. Messrs. O. also have a large trade, but it is principally connected with Cleethorpes, as is also the trade of Messrs. L. & C.

It would appear that oysters are imported from America and the Dutch and Danish coasts, and laid down on the Cleethorpes beds in the spring of the year. At other times the imported oysters go direct to the market. The trade at Cleethorpes for the year is practically over in September.

In the usual course of events, the oysters are brought ashore, and, if their shells are dirty, are placed in a sieve shaped as a pail, and then washed at a tap with water from the Great Grimsby Water Company's Works. They are then placed in sacks for short journeys, or in barrels if travelling to a distance. They are despatched to their destination the same day that they are brought ashore from the beds.

The oysters are sent to all parts of England, to Russia, Denmark, France, and to most European countries. The firm of Messrs. O. sends away from Cleethorpes 400,000 oysters per week in the season; and this fact, coupled with the circumstance that the cholera attacks which had occurred in connexion with oyster-eating were but few, was referred to by a member of this firm as a ground for disbelieving that Cleethorpes oysters gave people cholera. Both this gentleman and Messrs. M. said that it was, of course, quite possible that local tradesmen kept the oysters too long in their shops, and that although in winter oysters might be kept a week or 10 days, it was not advisable to keep them in the summer more than three days. By the courtesy of Messrs. M. I was allowed to see the books of the firm. On August 17th, a date I took at random, the firm had sent away many thousands of oysters to nearly every part of England.

The various firms employ locally—

Messrs. M. - - - - - -	16 men.
Messrs. O. - - - - - -	16 ,,
Messrs. L. - - - - - -	4 ,,
Messrs. C. - - - - - -	3 ,,

Additional hands are taken on during the season as the work requires. All the men employed by the above firms are at liberty to eat any number of oysters they may feel disposed to partake of. Only two men employed by these firms had diarrhœa during the summer.

There are at Cleethorpes several "bars" where oysters are sold to residents, visitors, and trippers during the summer months. Many of these bars are closed by the end of September. During my inspection of the place I visited all that were open and conferred with all the proprietors who could be found. I learnt that these tradesmen buy all their oysters from one of the firms previously mentioned, and that they only have a small quantity at a time; they send down to one of the wholesale firms as often as three or four times a day for a fresh supply when trade is brisk. I did not learn that oysters were kept in stock at Cleethorpes more than two days. Only at two of the bars were the oysters washed or dipped in water after opening the shell. In each of these cases the water used was tap water. At the other "bars" I was told that such a procedure would spoil the flavour of the oyster.

At Grimsby the local oyster trade is mostly in the hands of the firm of Messrs. O., mentioned above. These oysters are brought from Cleethorpes as they are required. The surplus stock is placed in "floats" inside the Fish Dock. These "floats" are large wooden trays, some 15 ft. × 10 ft., placed by the dock-piers, behind buttresses. The "top of the tide" flows over the buttress into the floats, and supplies them afresh with tidal-water twice in 24 hours. The oysters are not kept in these floats for any length of time, and the floats were mostly empty in September.

Oysters and Cholera.

It deserves to be borne in mind that about one million oysters were distributed from the Cleethorpes oyster beds each week last August, in all parts of the country, the fact, therefore, that a few persons suffered cholera soon after consuming oysters presumably from this source, appears, at first sight, to have no particular significance.

Nevertheless, a glance at the map of the coast that is annexed to this report will show that there is certainly a possible chance that the incoming tide may wash back Grimsby and Cleethorpes sewage over the oyster beds, and that the outgoing tide may deposit sewage matter on the oyster beds. But however this may be, the sewage in question must be profusely diluted by the large volume of water running out of the Humber.

It would seem indeed that the Grimsby oysters, on the floats inside the Docks, are more liable than oysters on the Cleethorpes beds to contamination, lying as they do in proximity to Grimsby Fish Dock sewer outfall. None of these oysters, however, have been complained of as associated locally with production of cholera, though this by no means proves that they have not had to do with causation of the disease.

In this connexion it is, however, of interest to note that I was informed that when the local Sanitary Authority laid the principal facts of a recent bacteriological examination of the dock-water before the representatives of the Manchester, Sheffield, and Lincolnshire Railway Company at Grimsby, the latter, not being in a position to refute the facts, charged the Sanitary Authority with polluting the water by the sewage from the outfall near the Fish Dock being carried back into that Dock.

D.

Mussel and Cockle Trade.

The firm of "Messrs. M.," mentioned above, have also a large "mussel" trade. This trade is worked under conditions practically identical with their oyster trade. The mussels are laid down in beds adjoining the oyster beds at Cleethorpes, and they are stored, washed, and despatched to various places in the same way as are the oysters. This firm have no "floats" in the Grimsby Docks.

There are numerous mussel beds along the coast, and mussels may be seen adhering to the sewage pipes; but only at Cleethorpes are they "farmed."

The mussels on the "open" beds are eaten locally: they are collected in small quantities for that purpose. No large or definite trade is done except by Messrs. M.'s firm.

Mussels, generally, on this part of the coast are more exposed to sewage than the oysters.

Cockles.

There is a large bed of cockles lying between the Grimsby sewer outfall by the Fish Docks, and the Beaconthorpe sewer outfall of Cleethorpes. Owing to the position of this cocke bed, it is, of course, exceptionally exposed to the influence of Grimsby and Cleethorpes sewage (*vide* map). Cockles are gathered by local people all along the coast, generally in small quantities, for consumption in the district.

In view of a seeming association between early cases of cholera and the consumption of cockles, inquiries were made into the uses to which cockles were put. As the result I was informed that cockles are cooked, usually by boiling, before being eaten. It does not appear that they are often eaten raw.

There does not appear to be any definite trade in cockles.

Hospital Ship ..... BRADFORD.

BOROUGH OF Gt. GRIMSBY. MAP I.

NOTIFICATIONS OF CHOLERA, CHOLERAIC DIARRHŒA, AND CHOLERA NOSTRAS. 1893.

Wyman & Sons, Ltd, Lith. 63, Carter Lane 6480 9.94

BOROUGH OF Gt. GRIMSBY. MAP II.

DEATHS FROM CHOLERA, CHOLERA NOSTRAS AND CHOLERAIC DIARRHŒA. 1893.

Wyman & Sons, Ltd, Lith, 63, Carter Lane. 6480. 9.94.

Borough of Gt Grimsby. Map III.

Cases of Diarrhœa Notified 6th to 13th September. 1893.

Wyman & Sons, Ltd, Lith, 63, Carter Lane 6480. 9. 94.

Borough of Gt. Grimsby. Map IV.

Notifications of Typhoid Fever 1893.

Wyman & Sons, Ltd, Lith, 63, Carter Lane 6480.3.94.

BOROUGH OF Gt GRIMSBY. MAP V.

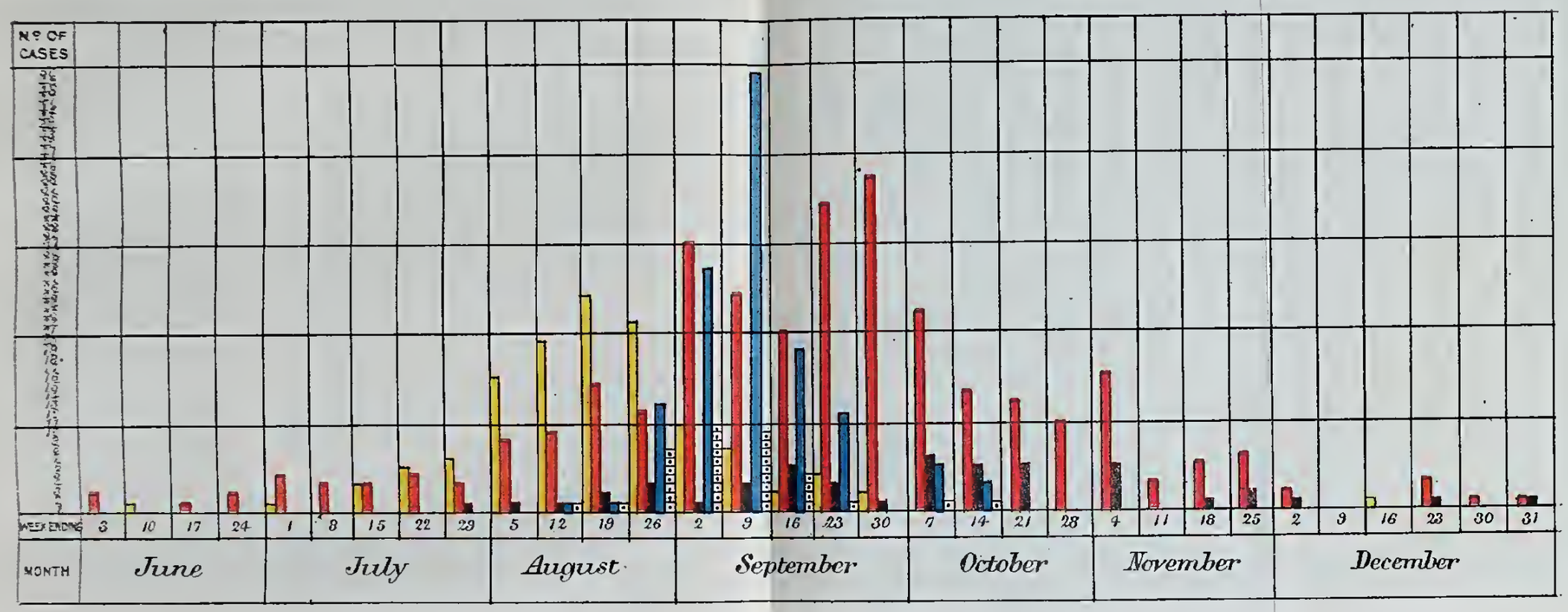
LOCATION OF PUMPS.

Wyman & Sons, Ltd, Lith, 63, Carter Lane 6192.7.94.

PLAN, SHEWING POSITION OF
5 FATAL CASES OF CHOLERA.
RIVER HUMBER
GRIMSBY SEWAGE OUTFALL
GRIMSBY SEWAGE OUTFALL
COCKLE BEDS
BEACONTHORPE SEWAGE OUTFALL
Sand
CHAMBER
NORTH WEST WARD
HUMBER WARD
NORTH EAST WARD
GREAT GRIMSBY
SOUTH WEST WARD
OYSTER & MUSSEL BEDS
WELLOW WEELSBY WARD
Cleethorpes
SOUTH WARD
C L E E
Acres
2556·406
CLEETHORPE
GREAT GRIMSBY
Acres
2161·420
HUMBERSTONE BECK SEWAGE OUTFALL
PRESENT SETTLING TANK
PRESENT OUTFALL INTO BECK
Wyman & Sons Ltd Lith

CHART I. *Showing the Deaths from Choleraic Disease, Enteric Fever, and Diarrhœa, and the notifications of Choleraic disease, and Enteric Fever, in the Great Grimsby U.S. District, during 1893. Corresponding to Table VI.*

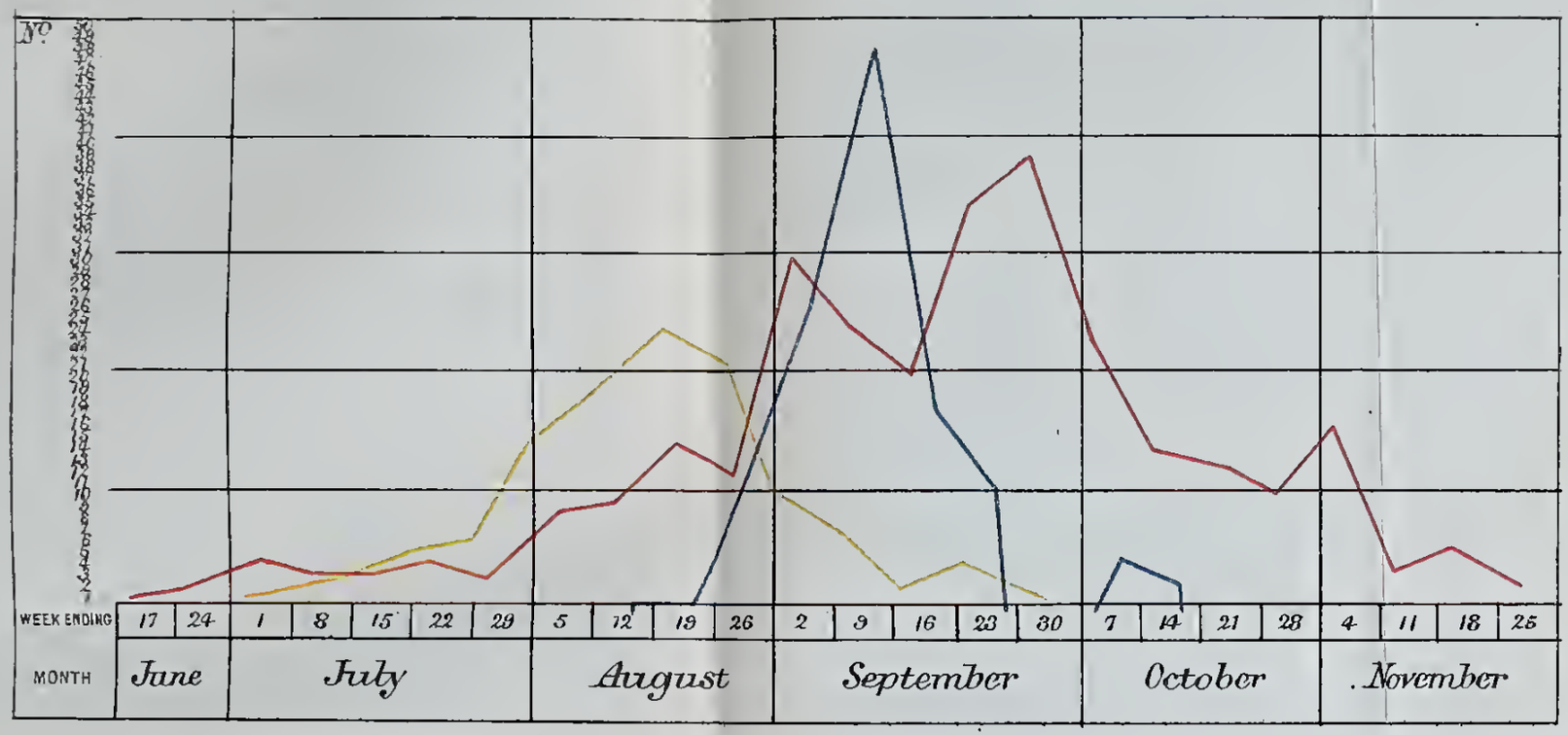
Deaths from Diarrhœa
Notifications of Enteric Fever
Deaths from Enteric Fever
Notifications of Choleraic Disease
Deaths from Choleraic Disease



WYMAN AND SONS LTD LITH 63 CARTER LANE 6480.10.94.

CHART II. *Shewing the number of Cases notified of Choleraic Disease, and Enteric Fever, and the number of Deaths attributed to Diarrhœa during the months of June–November 1893, in the Great Grimsby Urban Sanitary District.*

Deaths attributed to Diarrhœa
Notifications of Enteric Fever
" " Choleraic Disease



WYMAN AND SONS LTD LITH 63 CARTER LANE 6480 10,94.

No. 3.

Report on Cholera in the Borough of Kingston-on-Hull in 1893; by Dr. Theodore Thomson.

On the 24th of August 1893 a boy, eleven years of age, residing at 6, Havelock Terrace, Dansom Lane, Hull, was attacked by an illness from which he died on the same day. The following are the facts of the case.

The boy, who was in his usual health on August 23rd, awoke on the morning of August 24th about 5 o'clock, vomited a little and passed a loose motion. He had a similar attack at 6.30 a.m. and again at 9 o'clock a.m. Apart from these symptoms he is said to have appeared well and comfortable, and, in consequence, no medical man was called in. He took some nourishment in the form of cornflour and milk at 9 a.m. and again at 10.30 a.m. At the latter time he complained of aching pains in the calves of his legs. It is said that no aggravation of symptoms occurred until about 2 p.m. when, according to his mother, he "turned a peculiar colour," which so alarmed her that she gave him some brandy and sent for a doctor. The boy, however, died about 2.40 p.m., just before the doctor arrived. There was no diarrhœa nor vomiting after 9 a.m. On the following day, August 25th, an inquest was held on the body of deceased, and the jury returned a verdict that "death was caused by shock and collapse due to enteric "discharges from the bowels from acute causes." With the view of arriving, if possible, at a clearer appreciation of the cause of death, a portion of the lower bowel (ileum) of deceased was forwarded by the Sanitary Authority to Dr. Klein for bacterioscopic examination. This piece of ileum was received by Dr. Klein on August 28th, and on the following day he announced that the material sent him had afforded unequivocal indications of true cholera.

I had already, on August 28th, been instructed by the Board to visit Hull; and this I did on August 29th, making inquiry there on that and on days immediately following, as well as on several subsequent occasions. On the information thus obtained is based the account I now proceed to give of cholera in Hull in 1893 and of the circumstances under which it occurred there.

At an early stage of my investigations I sought to ascertain whether there had appeared in Hull prior to August 24th cases of disease which might have really been of a choleraic nature, although not definitely recognised as such at the time of their occurrence. As result I found that on August 16th a man, aged 61 years, and residing in a common lodging-house (also in the neighbourhood of Dansom Lane), had been attacked by diarrhœa, which became so severe on the following day, August 17th, that a medical practitioner was called in to attend him. When seen by the medical man on the latter date, the patient was confined to bed and was in a prostrate condition. His temperature was not higher than 97° Fahr.; his pulse was 100 and intermittent; his features were contracted; his voice was faltering; and he suffered from cramps, vomiting, and purging. During the course of the day, however, his illness abated; and he subsequently made a rapid recovery. Owing to his stools having been received in a pail containing disinfectants, bacterioscopic investigation had not been made in this instance. With the single exception of this case, inquiry failed to reveal the occurrence of attacks presenting choleraic symptoms in Hull in 1893 prior to August 24th. Thenceforward, therefore, attention was directed to the behaviour of cholera in the town subsequent to the date in question.

The fatal manifestations of choleraic disease in Hull, as illustrated by the *deaths* referred to cholera and to choleraic diarrhœa respectively, are recorded in the following table (Table I.). No deaths were in 1893 attributed to either of these causes prior to August 24th: nor during the period August 25th to 31st, both dates inclusive: nor after October 10th.

TABLE I.

Showing—(1.) DEATHS certified as due to CHOLERA in HULL (estimated population, 208,709) during the Period August 24th to October 10th, 1893.

Date of Death.	Sex.	Age.	Occupation.	Duration of Disease.
August 24	Male	11	Son of labourer	10 hours.
September 1*	Female	56	Widow of labourer	Not stated.
„ 3	„	19	Daughter of labourer	„ „
„ 4	Male	44	Labourer	24 hours.
„ 6	„	65	Labourer	24 „
„ 6	Female	45	Wife of labourer	8 „
„ 13	Male	40	Labourer	24 „
„ 18	„	64	Labourer	Not stated.
„ 18	„	27	Stereotyper	3 days.
„ 24	Female	35	Wife of oilmiller	1 day.
„ 25	Male	63	Fruiterer	2 days.
„ 26	„	53	Road contractor	30 hours.

And—(2.) DEATHS certified as due to CHOLERAIC DIARRHŒA in HULL during the Period August 24th to October 10th, 1893.

Date of Death.	Sex.	Age.	Occupation.	Duration of Disease.
September 3	Male	65	Innkeeper	Not stated.
„ 7	Female	68	Widow of retired gentleman	„ „
„ 11	„	11	Daughter of hairdresser's assistant	4 days.
„ 24	„	42	?	13 „
October 10	Male	9	Son of blacksmith's striker	Not stated.

It is thus seen that in Hull in 1893, 12 *deaths* were ascribed to cholera and 5 to choleraic diarrhœa; in all 17 deaths from choleraic disease, corresponding to a death-rate from this cause of 0·08 per thousand of population.

As to prevalence of choleraic *illness* in Hull, exceptional information is available for the period September 7th—October 12th, during which

* Material (*ileum*) from this case was sent to Dr. Klein for bacterioscopic examination. Briefly the history of the patient is as follows:—She was seized with diarrhœa on August 31st. In the course of the night following the diarrhœa became severe and was accompanied by cramps, abdominal pain, and vomiting. She was first seen by a medical man about 6 a.m. on September 1st, and was then in a state of collapse with husky voice and blue extremities. She died at 11.20 a.m. on the same day.

time medical men practising in the borough certified at the request of the Sanitary Authority all cases of "choleraic diarrhœa" that came under their notice; cases of cholera being meanwhile notified in the usual way in accordance with the provisions of the Infectious Disease (Notification) Act, which is in force in Hull. And in addition the Sanitary Authority gained knowledge of cases of choleraic disease through their own officers and in other ways. I am able, accordingly, to annex a table (Table II.) in which are enumerated day by day attacks of a choleraic character in Hull which came in one and another way to the knowledge of the Sanitary Authority between August 24th and October 12th. In considering, however, the data formulated in this table it must be borne in mind that prior to September 7th medical men had not been informed that notifications of choleraic diarrhœa would be paid for, and that accordingly cases coming to the knowledge of the Sanitary Authority during the period August 24th to September 6th were likely to be few relatively to those that became known on September 7th and following days.

Table II.

Showing, day by day, the Number of Cases of Cholera and Choleraic Diarrhœa known to have occurred in Hull during the Period August 24th to October 12th, 1893.

Date.	Number of Persons attacked by Cholera.	Number of Persons attacked by Choleraic Diarrhœa.	Date.	Number of Persons attacked by Cholera.	Number of Persons attacked by Choleraic Diarrhœa.
August 24 -	1	—	September 18 -	2	6
,, 25 -	—	—	,, 19 -	—	2
,, 26 -	—	—	,, 20 -	—	7
,, 27 -	—	—	,, 21 -	—	4
,, 28 -	—	—	,, 22 -	1	2
,, 29 -	—	—	,, 23 -	—	—
,, 30 -	—	—	,, 24 -	1	2
,, 31 -	—	—	,, 25 -	—	2
September 1 -	—	—	,, 26 -	1	2
,, 2 -	—	1	,, 27 -	—	2
,, 3 -	2	—	,, 28 -	—	1
,, 4 -	2	—	,, 29 -	—	2
,, 5 -	3	—	,, 30 -	—	2
,, 6 -	2	14	October 1 -	—	—
,, 7 -	—	29	,, 2 -	—	1
,, 8 -	—	16	,, 3 -	—	2
,, 9 -	—	10	,, 4 -	—	1
,, 10 -	—	4	,, 5 -	—	—
,, 11 -	—	6	,, 6 -	—	—
,, 12 -	1	9	,, 7 -	—	—
,, 13 -	—	3	,, 8 -	—	—
,, 14 -	—	6	,, 9 -	—	—
,, 15 -	1	6	,, 10 -	—	1
,, 16 -	—	6	,, 11 -	—	1
,, 17 -	—	2	,, 12 -	—	—

Total number of persons known to have been attacked by cholera from August 24th–October 12th - - - - - - - 17

Total number of persons known to have been attacked by choleraic diarrhœa from August 24th–October 12th - - - - 152

From the above table it appears that during the period August 24th to October 12th, 169 persons were, within the knowledge of the Sanitary Authority, attacked by sickness believed to be of a choleraic nature. Of this total 17 were classified as cholera, and 152 as choleraic diarrhœa. It is desirable, however, not to attach any considerable importance to the distinction thus made. For, during the period covered by Table II., 12 deaths were ascribed to cholera; and the cholera fatality ($\frac{12}{17}$) thus arrived at is so high as to afford ground for suspicion that not a few persons in the "choleraic diarrhœa" list really suffered from true cholera. On the other hand there should be hesitation in regarding all cases of "choleraic diarrhœa" as actually having been cases of true cholera. For, on dealing collectively with cholera and choleraic diarrhœa during the period under consideration, we find that not more than 17 deaths occurred among 169 cases of choleraic sickness. The fatality thus arrived at (10 per cent.) is sufficiently low to justifiy supposition that certain cases returned as "choleraic diarrhœa" were in reality cases of "summer diarrhœa," from a seasonal prevalence of which Hull, like many other places, suffers annually. It is worthy of note also that such attacks by choleraic diarrhœa as came to the knowledge of the Sanitary Authority did so mainly (for reasons already stated) on and after September 7th; and, accordingly, it is probable that, had the sources of information on and after the date mentioned been at the Authority's disposal in weeks antecedent to September 7th, the numbers of recorded cases of choleraic sickness would have been still higher and the fatality from this cause correspondingly more insignificant. These considerations, accordingly, might lead to belief that the number of persons actually attacked by choleraic disease was smaller than the return made to the Sanitary Authority of persons suffering from cholera and choleraic diarrhœa would seem to indicate.

But before accepting the foregoing thesis it becomes desirable to consider what was the nature and what the amount of the so-called "summer diarrhœa" in Hull in 1893. For inquiry in this sense might possibly lead to the discovery that this disease was then unusually prevalent, and, should this prove to have been the case, suspicion would arise that true cholera proving fatal might in part have been included in the "diarrhœa" mortality. Further, the type of the diarrhœa this year in Hull deserves attention, with a view to ascertaining whether it differed from that of other years after a fashion consistent with notable share of it having been in reality choleraic disease. I proceed, accordingly, to consider these two points; and deal, in the first instance, with the amount of diarrhœa known to have occurred in Hull in 1893.

Diarrhœa in Hull in 1893.

Knowledge of the amount of diarrhœa in Hull in 1893 is accessible in two ways. One of these is based on the deaths attributed to this cause; the other is derived from consideration of the number of diarrhœa attacks which came to the knowledge of the Hull Sanitary Authority during the period September 7th to October 12th. Knowledge of the latter sort is due in large part to notification by medical practitioners of cases of diarrhœa coming under their observation during the period September 7th to October 12th;* partly also to discovery of "diarrhœa" sickness by officers of the Sanitary Authority in the course of house-to-house investigations consequent on appearance of choleraic disease in the district.

* In response to the Sanitary Authority's request (see p. 2) that notification be given them of occurrence of choleraic diarrhœa in Hull, cases of diarrhœa as well as of choleraic diarrhœa were notified by the medical profession and paid for by the Authority.

The total number of deaths ascribed to diarrhœa in Hull in 1893 was 496, which, the estimated population of Hull in 1893 being 208,709, gives the exceptionally high mortality from this cause of 2 · 4 per thousand persons living. But the diarrhœa death-rate was, in 1893, unusually high throughout the whole country, and, accordingly, it is necessary for just appreciation of the position of Hull in that year to compare Hull with itself in this respect as regards former years, and the diarrhœa death-rate in the borough in 1893 with that for other towns in the same year. In the absence of figures for complete comparison in the above sense for the whole year 1893, a convenient means of contrast of this kind is at hand in a table published by the Registrar-General in his third quarterly return of each year. It is in this quarter that by far the greater number of deaths from diarrhœa occurs in this country ; and in this way, therefore, a sufficiently just means of comparison of diarrhœa incidence on various town districts is afforded. On the data thus provided is based the following table (Table III.), in which is shown the diarrhœa death-rate in Hull in the third quarter of 1893, as well as in the ten years 1883–92; and by which also is afforded means of comparison in these respects of Hull with other towns as well as with England and Wales.

Table III.

Showing (as an Annual Rate), for Hull, England and Wales, "28 great Towns," and "67 other large Towns," the Diarrhœa Mortality of the Third Quarter in each of the Eleven Years 1883-93 ; and giving in each instance, for purpose of comparison with 1893, the Mean of the Third Quarter Rates of the Ten Years 1883–92.

Third Quarter of the Year.	Rate per 1,000 Population in each Instance.			
	Hull.	England and Wales.	Great Towns.	Other large Towns.
1883 - - -	1·8	1·2	2·1	1·4
1884 - - -	6·0	2·7	4·0	3·2
1885 - - -	0·8	1·1	2·1	1·0
1886 - - -	4·5	2·3	3·7	2·6
1887 - - -	4·1	2·1	3·4	2·2
1888 - - -	0·9	0·9	1·6	1·0
1889 - - -	4·0	1·7	2·6	2·0
1890 - - -	2·6	1·3	2·1	1·4
1891 - - -	1·9	1·0	1·7	1·0
1892 - - -	2·9	1·2	2·0	1·5
Average in 10 Years 1883–92 - -	3·0	1·6	2·5	1·7
1893 - - -	8·4	2·8	3·5	3·8

From the figures in Table III. it appears that the death-rate from diarrhœa in Hull in the third quarter of 1893 greatly exceeded that of any one of the third quarters of the 10 years 1883–92. Further, the data in this table show that while there was indeed exceptional mortality from diarrhœa in the third quarter of 1893 in England and Wales, in the 28 great towns, and in the 67 other large towns, the excess

above the average was in each instance much less marked than it was in Hull during the same period. So far, therefore, as any conclusion regarding the prevalence of "diarrhœa" sickness may be arrived at from mortality due to this cause, it would appear that Hull in this respect suffered, in the third quarter of 1893, not only more than was usual in that borough, but also relatively, as well as actually, far more than did the remainder of the country.

Further information on this subject is afforded, as already stated, by knowledge of a number of diarrhœa *attacks* during the period September 7th to October 12th. In the following table (Table IV.) is contained a statement of the number of those that came to the knowledge of the Sanitary Authority day by day during the period mentioned.

Table IV.

Showing, day by day, the Number of Persons known to have been attacked by Diarrhœa in Hull during the Period September 7th to October 12th, 1893.

Date.	No. of Persons attacked by Diarrhœa.	Date.	No. of Persons attacked by Diarrhœa.
September 7 - -	38	September 25 - -	12
„ 8 - -	37	„ 26 - -	2
„ 9 - -	30	„ 27 - -	5
„ 10 - -	15	„ 28 - -	4
„ 11 - -	39	„ 29 - -	—
„ 12 - -	56	„ 30 - -	2
„ 13 - -	21	October 1 - -	1
„ 14 - -	10	„ 2 - -	2
„ 15 - -	19	„ 3 - -	3
„ 16 - -	15	„ 4 - -	3
„ 17 - -	4	„ 5 - -	4
„ 18 - -	22	„ 6 - -	3
„ 19 - -	10	„ 7 - -	—
„ 20 - -	13	„ 8 - -	—
„ 21 - -	13	„ 9 - -	—
„ 22 - -	5	„ 10 - -	—
„ 23 - -	7	„ 11 - -	—
„ 24 - -	1	„ 12 - -	—

Total persons known to have been attacked by diarrhœa during the period September 7th–October 12th - - - - } 396

In considering the data provided by the above table, it should be borne in mind that, anterior to the time when medical practitioners commenced to notify "diarrhœa" *sickness* there had been a large amount of diarrhœa in Hull. This will appear from a table (Table VI.) and chart which will, in another connexion, be given at a later stage of this report. Statistics, therefore, as to "diarrhœa" sickness during the period September 7th to October 12th represent only a part, and that probably a small part, of the total "diarrhœa" sickness in Hull in 1893. Subject to this limitation, however, the figures in Table IV. are of value as indicating the amount of known diarrhœa during a considerable part of the time when recognised choleraic disease prevailed in Hull.

Since it appears from the data I have given that in 1893 Hull suffered from diarrhœa not only more than in any year during the previous decade, but also in excess of the remainder of the country in 1893, it is desirable to consider whether this unusual prevalence of diarrhœa was accompanied by departure from the ordinary type of summer diarrhœa as known in this country.

The feature hitherto accepted as differential of ordinary summer diarrhœa from diarrhœal disease of choleraic nature is the dissimilar incidence, in these two classes of malady, of deaths on the population at different ages; and accordingly I proceed to consider cholera, choleraic diarrhœa, and diarrhœa in Hull in 1893 from this point of view.

Age Distribution of Deaths from Cholera, Choleraic Diarrhœa, and Diarrhœa in Hull in 1893.

As already stated, in Hull in 1893, 17 deaths were ascribed to choleraic disease and 496 to diarrhœa. In the following table (Table V.) these deaths are classified in certain age groups.

Table V.

Showing the Number of Deaths attributed respectively to Choleraic Disease and Diarrhœa in Hull in 1893, classified according to their Ages.

Age-period.	No. of Deaths due to Cholera and Choleraic Diarrhœa.	No. of Deaths due to Diarrhœa.
Under 1 - -	—	384
1–5 - - -	—	63
5–15 - - -	3	5
15–60 - - -	9	20
Over 60 - -	5	24
At all ages - -	17	496

From these figures it appears that the incidence of fatal cholera was entirely on persons aged five years and upwards, and especially on these in the age group 15–60, while the "diarrhœa" deaths fell mainly on persons under five years of age. The number of deaths, however, referred to choleraic disease is too small to permit any very definite conclusion being based on them. The "diarrhœa" deaths exemplify the fact that in this country, fatal diarrhœa falls much more heavily on the infantile class than on the adult portion of the community.

The following table (Table VI.) shows the incidence of fatal "diarrhœa" in Hull in 1893 on persons under five and also on persons five years of age and upwards; and affords means of comparing in this respect fatal "diarrhœa" in Hull in 1893 with that in the same place during the seven years 1886–92.*

It will be observed that in Hull in 1893 the age incidence of fatal "diarrhœa," as illustrated by the following table (VI.), did not materially differ from that of the same disease during the seven years 1886–92 in that borough. For in 1893 the ratio of mortality from "diarrhœa" among persons under the age of five to the mortality from that cause among persons aged five years and upwards was 61 to 1; while this

* Data prior to the year 1886 were not available.

ratio during the seven years 1886–92 had been 58 to 1. Accordingly, evidence based on mortality referred to "diarrhœa" at certain age-groups does not tend to encourage belief that this disease in Hull in 1893 showed material departure from the ordinary type of summer diarrhœa there.

TABLE VI.

SHOWING YEAR BY YEAR for the EIGHT YEARS 1886–93 the incidence of FATAL DIARRHŒA on PERSONS under the Age of 5 and PERSONS aged 5 YEARS and upwards respectively: and affording means of comparison of the DEATH-RATE from this disease per 1,000 PERSONS living for each of these age-groups during the same PERIOD.

Year.	Persons under 5 Years of Age.				Persons aged 5 Years and Upwards.				Ratio of Diarrhœa Mortality at Ages 5+ to Mortality from like cause at 0–5 Years.	Average Ratio of Diarrhœa Mortality at Ages 5+ to Mortality from like cause at 0–5 Years during the Period 1886–92.
	Estimated Population.	Number of Deaths from Diarrhœa.	Diarrhœa Death-rate per 1,000 living.	Average Death-rate per 1,000 living from Diarrhœa, 1886–92.	Estimated Population.	Number of Deaths from Diarrhœa.	Diarrhœa Death-rate per 1,000 living.	Average Death-rate per 1,000 living from Diarrhœa, 1886–92.		
1886	25,031	237	9·47		157,862	25	0·16		to 59	
1887	25,296	193	7·63		161,077	24	0·15		1 to 51	
1888	25,563	70	2·74		164,359	16	0·10		1 to 27	
1889	25,833	215	8·32	6·38	167,707	19	0·11	0·11	1 to 76	1 to 58
1890	26,106	169	6·47		171,123	14	0·08		1 to 81	
1891	26,374	109	4·13		174,560	13	0·07		1 to 59	
1892	26,649	161	6·04		178,101	16	0·09		1 to 67	
1893	26,938	447	16·59		181,771	49	0·27		1 to 61	

In addition to consideration of age distribution of deaths ascribed to choleraic disease and to "diarrhœa" respectively, regard was had to the incidence on certain age-groups of known *sickness* caused by each of these maladies.

To the results of inquiry made in this sense much importance was not attached, partly because of the limited duration of the period during which diarrhœal sickness was notified, with consequent incompleteness of knowledge as regards the remainder of the year, and partly because of the want of definite data as to age-distribution of summer diarrhœa in this country, wherewith the Hull figures might be contrasted. The general character, however, of the Hull attack rates from the two diseases referred to was not such as to afford evidence that "diarrhœa" in Hull in 1893 was of different sort from that seasonally prevalent every year in many parts of this country.

It should however be borne in mind that, while the facts quoted as regards age-distribution of diarrhœal sickness as well as those referring to deaths attributed to this cause at different age-groups would seem to be incompatible with large share of the Hull "diarrhœa" in 1893 having been in reality due to cholera, yet they cannot be regarded as excluding the possibility that some smaller portion of the mortality from the former disease may have been actually due to the latter in unrecognised form. Furthermore, if reason should yet appear for hesitancy to

accept the commonly received view that age-incidence of mortality from diarrhœa is dissimilar from that of cholera mortality, it would result that there is nothing in the facts observed at Hull which is inconsistent with the view that even large part of the "diarrhœa" in that borough in 1893 may have been due to cholera.

Before proceeding further to consider choleraic disease and diarrhœa in Hull in 1893, there is need to refer to a fact which came to my knowledge in the course of my investigations, and which is worthy of attention in connection with the prevalence of choleraic disease. I allude to the circumstance that there was in Hull in 1893 an unusually large amount of enteric fever.

Enteric Fever in Hull in 1893.

In Hull during 1893, 671 cases of enteric fever were notified to the Sanitary Authority as having occurred in the borough; and to this cause were attributed 90 deaths in the course of the year. In 1893, therefore, 32 out of every 10,000 persons living in Hull were attacked by enteric fever, while rather more than 4 out of every 10,000 persons died of this disease. The following figures afford means of contrasting these rates with corresponding mean annual rates for certain groups of towns, and for Hull itself, in other years.

Sickness	*Hull:* sickness rate from enteric fever per 10,000 of population in 1893 - - - -	32
	41 *Notification towns:* sickness from enteric fever per 10,000 of population in 5 years, 1883–87 -	14
Mortality	*Hull:* death-rate from enteric fever per 1,000 population in 1893 - - - -	0·43
	Hull: death-rate from "fever"* per 1,000 population in the years 1882–91 - - -	0·26
	Twenty-eight large towns: death-rate from "fever"* per 1,000 population in 10 years 1882–91 -	0·25

From these figures it appears not only that there was in Hull in 1893 a considerably greater amount of enteric fever than is usual in that borough, but also that the attack-rate and the death-rate there from this cause were markedly greater than has obtained in the groups of towns.

Reverting now to choleraic illness and to diarrhœa in Hull in 1893, it becomes of interest to inquire what relationships, if any, obtained between these diseases on the one hand, and between them and enteric fever on the other hand, as regards their distribution in *time* and also as regards their distribution in *area*.

Distribution in TIME of Choleraic Disease, Diarrhœa, and Enteric Fever in Hull in 1893.

The following table (Table VII.) and the chart † accompanying this report afford means of comparing the distribution in time of the above-mentioned diseases in Hull in 1893. In this table are given week by week the *deaths* ascribed to choleraic disease and to diarrhœa respectively throughout the whole year; the ascertained *attacks* of choleraic disease during the period August 24th to October 12th; and *attacks* of enteric fever notified to the Sanitary Authority throughout the whole year. Here again, however, must be borne in mind the probably incomplete record of attacks by choleraic disease during the period August 24th to September 6th.

* "Fever" includes, in addition to enteric fever, typhus and simple or ill-defined forms of continued fever.

† The chart does not deal with the whole year but only with those months during which one or another of the diseases recorded was notably prevalent.

Table VII.

Showing Week by Week for 1893 the Number of Persons ascertained to have been attacked by Choleraic Disease and by Enteric Fever in Hull; as well as the Deaths in each Week registered as due to Choleraic Disease and to Diarrhœa in the Borough.

Weekly Periods, 1893.	No. of Persons attacked by Choleraic Disease.	No. of Deaths from Choleraic Disease.	No. of Diarrhœa Deaths.	No. of Persons attacked by Enteric Fever.
Week ending January 7		—	—	5
,, ,, 14		—	—	2
,, ,, 21		—	1	5
,, ,, 28		—	—	4
,, February 4		—	—	1
,, ,, 11		—	—	—
,, ,, 18		—	2	2
,, ,, 25		—	—	—
,, March 4		—	1	3
,, ,, 11		—	—	3
,, ,, 18		—	—	2
,, ,, 25		—	—	1
,, April 1		—	—	5
,, ,, 8		—	1	1
,, ,, 15		—	—	—
,, ,, 22		—	—	—
,, ,, 29		—	—	2
,, May 6		—	—	2
,, ,, 13		—	1	3
,, ,, 20		—	—	3
,, ,, 27		—	1	3
,, June 3		—	—	3
,, ,, 10		—	—	6
,, ,, 17		—	2	1
,, ,, 24		—	5	1
,, July 1		—	7	4
,, ,, 8		—	17	6
,, ,, 15		—	27	4
,, ,, 22		—	48	7
,, ,, 29		—	27	8
,, August 5		—	38	9
,, ,, 12		—	23	8
,, ,, 19		—	51	16
,, ,, 26	1	1	46	17
,, September 2	1	1	52	27
,, ,, 9	78	6	39	56
,, ,, 16	42	2	36	50
,, ,, 23	26	2	24	62
,, ,, 30	15	4	22	57
,, October 7	4	—	5	41
,, ,, 14	2	1	6	46
,, ,, 21		—	3	35
,, ,, 28		—	—	43
,, November 4		—	1	25
,, ,, 11		—	2	25
,, ,, 18		—	1	15
,, ,, 25		—	—	11
,, December 2		—	2	10
,, ,, 9		—	3	13
,, ,, 16		—	1	6
,, ,, 23		—	1	8
,, ,, 30		—	—	4
Totals - -	169	17	496	671

Consideration of Table VII. and the corresponding chart tends to the conclusion that cholera in Hull attained its maximum about the time when fatal diarrhœa, having reached its highest point, had already begun to decline. There was, it will be seen, approximate coincidence of maximum cholera with maximum enteric fever. The decline, however, of enteric fever was certainly slower than that of cholera; indeed there was still a considerable amount of the former in early November, whereas by the end of September the latter had almost disappeared.

A point not devoid of interest is the double peak (*see* chart) of the diarrhœa curve, the first occurring in the month of July, the second in late August. In this respect the Hull diarrhœa curve differs from that of most of the 33 large towns in the third quarter of 1893. Thus in 21 of these towns deaths from diarrhœa attained their highest point in July; and in other four this maximum was reached in early August. To this point I shall again make reference when I come to consider the conditions under which cholera maintained itself in Hull.

Distribution in AREA of Choleraic Disease, Diarrhœa, and Enteric Fever in Hull in 1893.

Table VIII. affords means of contrasting the extent to which various parts of Hull were invaded by choleraic disease, diarrhœa, and enteric fever respectively. It denotes for each of the registration sub-districts comprised in the borough:—the number of known attacks of choleraic disease during the period August 24th to October 12th; the diarrhœa attacks during the period September 7th to October 12th; and the enteric fever cases during the whole year.

Table VIII.

Showing for each Registration Sub-District and for the whole Borough of Hull the Number of Persons ascertained to have been attacked by Choleraic Disease and Diarrhœa in certain Weeks of 1893, as well as the Number of Enteric Fever Cases notified during the whole year; together with the Attack Rate from these causes per 1,000 Population in each instance.

Registration Sub-District.	Acreage.	Population.	Cholera and Choleraic Diarrhœa, Aug. 24 to Oct 12.		Diarrhœa, Sept. 7 to Oct. 12.		Enteric Fever during the whole Year.	
			No. of Attacks.	Attack Rate per 1,000 Population.	No. of Attacks.	Attack Rate per 1,000 Population.	No. of Attacks.	Attack Rate per 1,000 Population.
Drypool	1,561	32,305	22	0·7	69	2·1	72	2·2
Sutton	269	12,765	6	0·5	13	1·0	32	2·5
East Sculcoates	250	13,661	8	0·6	17	1·2	97	7·1
West Sculcoates	487	42,364	51	1·2	56	1·3	166	3·9
Humber	61	5,566	3	0·5	11	1·9	12	2·2
St. Mary	53	3,168	1	0·3	14	4·4	7	2·2
Myton	940	70,699	67	0·9	176	2·5	226	3·2
Newington	1,340	20,177	8	0·4	30	1·5	41	2·0
Newland	1,130	6,730	3	0·4	8	1·2	7	1·0
Stoneferry	525	953	—	—	2	2·1	11	11·5
Marfleet	1,285	251	—	—	—	—	—	—
Borough of Hull	7,901	208,639*	169	0·8	396	1·9	671	3·2

* These figures, which are obtained from local sources, differ slightly from those of the borough population as estimated by the Registrar-General, referred to in other parts of this Report.

From this table it will be seen that:—

1.—The *choleraic* attack-rate for the whole borough from August 24th to October 12th, which was 0·8 per thousand persons living, was exceeded in the registration sub-districts of West Sculcoates and Myton, where it was 1·2 and 0·9 respectively.

2.—The *diarrhœa* attack-rate for the whole borough from September 7th to October 12th, which was 1·9 per thousand persons living, was exceeded in the registration sub-districts of Drypool, St. Mary's, Myton, and Stoneferry, where it was 2·1, 4·4, 2·5, and 2·1 respectively.

3.—The enteric fever attack-rate for the whole borough, which was 3·2 per thousand per annum, was exceeded in the registration sub-districts of East Sculcoates, West Sculcoates, and Stoneferry, where it was 7·1, 3·9, and 11·5 respectively.

In comparing these attack-rates by the three diseases in question, the districts of Marfleet and Stoneferry may be entirely neglected by reason of the very small figures in each instance; while, for a similar though less strongly marked reason, little importance is to be attached to rates of districts so small as St. Mary's, Humber, and Newland. Of the remaining six districts, Myton and West Sculcoates stand out as exceeding the average attack-rate in the case of two out of the three diseases: Myton in reference to choleraic disease and diarrhœa, West Sculcoates as regards choleraic disease and enteric fever. As to Myton, it should be further noted that the enteric fever attack-rate, although it does not exceed, nevertheless equals the average attack-rate of the whole borough. Drypool and East Sculcoates are each in excess of average attack-rates of one disease; namely, diarrhœa in the case of Drypool and enteric fever in the case of East Sculcoates. The incidence of enteric fever in the latter district is very marked. The attack-rates in two remaining of these six districts are below the attack rates of all three diseases for the borough. While, therefore, no districts other than Marfleet and Stoneferry have entirely escaped invasion by choleraic disease, and while none save Marfleet have been free from diarrhœa and enteric fever, the differences in amount of these diseases in the several sub-districts are of a nature to indicate that there has been at least some degree of localisation of the three maladies in question in certain parts of the borough. This view is strengthened by study of the two spot maps appended to this report. One of these maps shows the distribution of enteric fever attacks throughout the year; the other shows the distribution of cholera, choleraic diarrhœa, and diarrhœa attacks, during the period August 24th to October 12th for the first-named two diseases, and during the period September 7th to October 12th for the last-named disease. In Myton, for example, there are seen three areas especially thickly dotted in each map, and while these affected areas cannot, on comparison of the two maps, be said to correspond accurately, they nevertheless do so approximately. In West and East Sculcoates the spots in the two maps correspond in a general way; while in Drypool and Sutton there is also resemblance in their manner of distribution. Reference to these facts will again be made by me in dealing with the question of maintenance of cholera in Hull.

Causation of Choleraic Disease in Hull in 1893.

In searching for the cause of cholera and choleraic diarrhœa in Hull in 1893, attention was directed in the first instance towards the manner

in which cholera may have been introduced into the district; and, secondly, consideration was given to the way or ways in which cholera, after introduction into the borough, had been maintained there.

Manner of introduction of Cholera into Hull.

The first recognised case of cholera in Hull occurred, it will be remembered, on August 24th. Into the previous history and the actions of this boy during several days immediately antecedent to his illness minute inquiry was made, with the view of ascertaining in what way he might have been exposed to infection by cholera. Careful investigation failed to reveal that he had been in communication direct or indirect with the man described on p. 1 as having, on August 16th, been attacked by a malady presenting choleraic symptoms, or with any other person suffering from illness which could be regarded as of a choleraic nature. Further, it did not appear that he had partaken of any article of food which there was sufficient ground for considering a possible medium of choleraic infection. But I ascertained that it had been the practice of the deceased (as of other boys) to bathe in one of the land drains which I describe at a later stage of this report as intersecting Hull. The particular land drain in which the deceased was wont to bathe is that known locally as the "Sutton Drain," more properly described as the Holderness high level drain. Into it, up to and at the time of the illness of deceased, flowed a considerable amount of sewage from certain houses in Hull as well as from a few in the Sculcoates Rural District beyond the borough. In addition the land adjacent to it in the country district is liable to be freely manured with night soil; and, moreover, it is stated to be the custom of the occupants of numerous houses on the banks of that part of the drain which is within the borough to throw into it liquid refuse as well as garbage.

It appears, from statements made to me by companions of deceased, that the latter while bathing in the drain about 1 p.m. on Wednesday, August 23rd, swallowed a mouthful of the water, at a time when this was exceptionally foul by reason of the bathers having stirred up black mud from its bottom. Deceased immediately came out of the water and commented on the unpleasant taste of that which he had swallowed. It will be remembered that his illness commenced next morning, August 24th, at 5 a.m. and terminated fatally the same day at 2.40 p.m. Of six companions of the deceased who had along with him bathed in the drain on August 23rd, and who had also swallowed water, I ascertained that three suffered from diarrhœa within a period ranging from 12 to 18 hours afterwards. Of the remaining three one vomited immediately after swallowing some of the water, and experienced no subsequent ill-effects; a second suffered from nausea for about an hour after swallowing the water; and the third displayed no symptoms of illness consequent on swallowing the water unless a headache which he suffered from during school time that afternoon may be attributed to this cause.

With the view of ascertaining if possible whether the Sutton drain water contained the contagium of cholera I collected and forwarded two samples thereof to Dr. Klein for bacterioscopic examination. In one of these samples Dr. Klein ascertained the presence of a bacillus which presented all the appearances and gave all the reactions of Koch's comma bacillus. It appeared, therefore, probable that the boy who was attacked and died on August 24th had contracted cholera from swallowing water in the Sutton drain, to which in some way the infectious material of that disease had gained access. It therefore became of interest to

ascertain, if possible, in what way the water of the drain in question might have become infected. To this end careful inquiry was made at all houses from which sewage passed into the Sutton drain, and at all houses situated on its banks—without as well as within the borough of Hull,—with a view to ascertaining whether diarrhœal sickness of a suspicious character had been known to exist among their inmates during 1893 prior to August 23rd. In several of these houses diarrhœa was found to have prevailed anterior to the date mentioned, but in no instance was a history obtained such as would afford reasonable ground for suspecting one of these diarrhœa cases to have been in reality a case of cholera.

Efforts to trace further the source of infection of the case of August 24th having failed, I sought next to ascertain whether the person attacked on August 16th by sickness bearing a suspicious resemblance to choleraic disease had been exposed to infection of the sort.* This person who, it will be remembered, resided in a common lodging-house, was a labourer engaged in deal carrying at one of the Hull docks. He had been out of work since August 4th, but nevertheless frequented the docks during the days between August 4th and 16th. There is, however, no definite knowledge of his having held communication with any person from a cholera-invaded place or with anyone known to have been suffering from illness of a suspicious character. In like manner there is no history of occurrence of suspicious illness in the common lodging-house at which he resided and of which he had been an occupant for four months prior to his attack. If then the illness from which this person suffered was of a choleraic nature, the manner in which he contracted the disease remains uncertain.

Inquiry, therefore, with the view of definitely ascertaining how cholera was introduced into Hull gave negative results. Failure of this sort, however, need not be matter for surprise. For cholera was in 1892 epidemic in Hamburg, with which town Hull is in constant communication, and was also to a less degree prevalent elsewhere abroad; while in 1893 cholera is known to have existed not only on the Continent of Europe but also during the early autumn at Grimsby, a town not far distant from Hull, with which it has considerable traffic. As matter of fact in the autumn of 1892 three persons suffering from cholera are known to have arrived in Hull. One of these was on board a vessel from Cronstadt and St. Petersburg; the other two were on vessels from Hamburg. All these persons were detained by the Port Sanitary Authority, and were isolated at the "Garrison" Hospital of the Hull Urban Sanitary Authority. (The Port Sanitary Authority had not then, as they now have, a floating hospital near Hull in the River Humber.) The excreta of these cases of 1892 were cremated and their belongings were disinfected. Slop-waters from the Garrison Hospital discharge directly into the Humber (see my account of sewerage and drainage at a later stage of this report). Two of the patients recovered, the third died and was interred in the Hedon Road cemetery. Watch was kept over the health of all persons on board the vessels which had brought cholera cases to Hull in 1892, and these vessels, with all articles thereon that might have been exposed to infection, were duly cleansed and disinfected. In 1893, prior to the occurrence of the case of August 16th, already described by me, no person suffering from choleraic disease is known to have arrived in Hull.

* As has been said, the most careful inquiry failed to reveal that there had been any communication, direct or indirect, between this person and the boy who died on August 24th.

Such information, therefore, as is forthcoming does not tend to clear up the obscurity of origin of cholera in Hull in 1893. It is open to anyone to contend that some person or persons suffering from cholera, not recognised as such, arrived in either 1892 or 1893 in Hull and deposited there the infection of the disease. Persons in seeming good health, but who, after landing, develop slight and unrecognised cholera, would not, of course, be detained by the Port Sanitary Authority, nor would they later on be reported to the Urban Sanitary Authority as suffering from cholera. That in this way cholera may have gained access to and become established in Hull is not to be denied; but I am not in possession of any data definitely supporting this hypothesis.

Subsequent Maintenance of Cholera in Hull.

Propagation by Personal Communication.—In so very few instances was personal communication, direct or indirect, found to have taken place between occupants of invaded households and persons who had been suffering from disease of a choleraic nature, that no adequate explanation could in this way be found for the maintenance of cholera in Hull subsequent to the date at which it is ascertained to have made its appearance there. In the absence therefore of satisfactory explanation of this sort attention was directed towards conditions one or other of which might have tended to prolong the existence of cholera when it had gained admittance to the district. In this way were passed in review the general sanitary circumstances, the sewerage and drainage arrangements, the disposal and removal of excreta and refuse, the milk supply, the water supply, and the sanitary administration of the borough; and with result as follows.

General Sanitary Circumstances.—The district comprised by the borough of Kingston-upon-Hull (population estimated in the middle of 1893 at 208,639) covers an area 7,901 acres in extent. It occupies an alluvial flat of which the surface levels range from 6½ to 17 feet above Ordnance Datum, averaging 8 feet above Datum. In great part the district is below high water level of ordinary spring tides (12 feet above O.D.). Geologically, Hull stands upon deposits filling up a hollow basin in the Chalk; the latter lying at a depth varying from 35 to 100 feet below the present ground-surface. The superficial soil consists of several feet of pure brick-clay which merges, from above downwards, into silts of differing density. Both clay and silt are wet and retentive of moisture, but the underground water is rarely found at a depth of less than 20 feet from the surface. The town, which lies on the north bank of the River Humber, is intersected by the River Hull as well as by the great agricultural drains of Holderness to the east of the River Hull, and of Skidby, Cottingham, and Beverley to the west of it. These drains, which discharge into the Hull and the Humber through tidal gates, cut through the upper clay into the silt, but they are stated to be watertight and retentive of their contents. Roadways are generally well paved and scavenged. House yards, courtyards, alleys, and passages are for the most part paved with stone flags, bricks, or cement, and kept in cleanly condition. The houses inhabited by the poorer classes are usually two-storey brick cottages each occupied by one family only. The condition of these dwellings on the whole is fair, although exceptions to the rule are not wanting. In many of the older parts of Hull, however, houses are huddled together without sufficient regard for the amount of air space that should surround dwellings.

Sewerage and Drainage.—There are in Hull three areas with separate sewerage systems and distinct sewage outfalls. One of these occupies the whole of that part of the borough which lies to the east of the River Hull, with the exception of a few outlying houses which drain into cesspools; the other two occupy the remainder of the borough which lies to the west of the River Hull. Of the two latter areas one is small and is formed by an island enclosed by the Humber on the south, the "old harbour" (into which the River Hull discharges) on the east, and the Queen's, Prince's, and Humber Docks on the west. The other of these two areas comprises the whole of the borough lying to the west of the River Hull, except the island just described. To the first of these three areas I shall allude as the "eastern," to the second as the "central," and to the third as the "western" sewerage area.* In all three areas main sewers are constructed of brick and are oval in shape; subsidiary sewers are stoneware pipes. The fall of sewers in the borough is necessarily small by reason of the flatness of the district. The sewers are, however, said to be regularly flushed, and are for the most part fairly well ventilated, although in this latter respect there is room for improvement. The sewage of the "western" area has continuous outfall into the Humber, into which it is delivered by means of pumps. At the time of cholera prevalence there was no pumping station for the "central" or for the "eastern"† area, of which the sewage accordingly was tide-locked during considerable part of the 24 hours. The sewage from all three areas is discharged in a crude state into the Humber. House drainage in Hull is effected by means of sanitary pipes, which are, however, for the most part not properly disconnected from sewers or sufficiently ventilated. Yard and sink-pipe gullies are properly trapped, and interiors of houses are in almost all instances disconnected from drains.

Disposal and Removal of Excreta and Refuse.—Hull is in great part a midden-privy town; the privy generally in use being of small size, and having its bottom at or slightly below ground level. These midden-privies, though doubtless an improvement on the ancient midden that still prevails in many northern towns, fall short in a sanitary sense of the fixed privy receptacles that are permissible under byelaws based on the Board's model. Not infrequently the Hull privies are found to smell offensively, and such of them as cannot be cleansed without purveyance of their contents through the dwelling are altogether objectionable. In the better class parts of the town, however, there are many water-closets, and recently these have been here and there introduced into the lower class neighbourhoods also. House refuse is added to the midden privy contents where this method of excrement disposal is in use; and it is deposited in separate receptacles, for the most part movable, where water-closets are employed. Scavenging of excreta and refuse, which is carried out by contractors, leaves room for improvement, though the contents of the receptacles containing excrement and refuse are stated to be removed not less seldom than once a week. The contents of privies are disposed of as manure to farmers, while dry refuse is burnt in a destructor erected by the Sanitary Authority in 1881. In this destructor are also burnt contents of pails

* The sewage of a small island which lies between the central and the eastern sewerage areas, discharges directly into the Humber and is not connected with any of the three sewerage systems above described. On it stand the Garrison Hospital, one inhabited house, cattle sheds, and sundry wood yards.

† A temporary pumping station has since been erected (November 1893) for the eastern district.

removed from houses invaded by enteric fever; a precaution extended in part of 1893 to houses invaded by disease of a choleraic character or by diarrhœa.

From the account I have given of the general sanitary circumstances, the sewerage and drainage arrangements, and the methods of disposal and removal of excreta and house refuse, it will be seen that in all these respects the state of Hull leaves a good deal to be desired. It appears that the town is low-lying and situated on soil of a sort not the most conducive to conditions encouraging health. Under these circumstances unwholesome conditions of the kind noted by me, namely, flatness of sewers, with occasionally defective ventilation of some of them, insufficient disconnection of house-drains from sewers, shortcomings as regards disposal and removal of excrement and refuse, and huddling together of houses of the poorer class, become the more dangerous. It is true that no evidence appeared which pointed to sewerage or to drainage arrangements as directly related to cholera maintenance; nor did I find reason to directly attribute persistence of the disease to methods of disposal and removal of excreta and refuse. Nor were all houses invaded by cholera those of the poorer class. But it is a noteworthy fact that the majority of invaded houses were in those neighbourhoods where poorer class dwellings are huddled together, and where conditions of cleanliness and free access of light and air are at a minimum. These facts tend to encourage a thesis that the cholera contagium, having gained access in some way to the soil on which the borough stands, found there a suitable medium for maintaining itself, and was thus enabled to select for subsequent attack inhabitants of the town living under the most unwholesome conditions. A similar preference for a particular class of person and locality would appear to have been exhibited by both diarrhœa and enteric fever in Hull in 1893, the areas especially affected by these latter diseases having been approximately the same as those invaded by choleraic disease. The double peak in the Hull diarrhœa curve in 1893, considered already under the heading of "distribution in time" of these three diseases, may also be regarded as pointing to a part played by the above unwholesome conditions in maintaining cholera in the borough. For the unusual prolongation and the late severity following on the earlier prevalence, also considerable, of diarrhœa in Hull, as contrasted with most other towns, would seem to indicate that in this town the contagium of this disease found itself in circumstances especially suited to its development. However this may be, diarrhœa in Hull exhibited tendency to especial manifestation in localities exceptionally affected by choleraic disease and by enteric fever. It is, accordingly, probable that in the maintenance of cholera as well as of diarrhœa and enteric fever in Hull in 1893 the "general sanitary circumstances" of the place directly, and conditions of sewerage and of excrement and refuse disposal and removal indirectly, played at least a not unimportant part.

Milk Supply.—The source of milk supply was ascertained in the case of all houses invaded by cholera, choleraic diarrhœa, diarrhœa, or enteric fever. From the information thus obtained, however, nothing appeared tending to cast on any particular source of milk supply suspicion of its having acted as a medium for the transmission of any of these diseases in the borough.

Water Supply.—The water supply to the borough is obtained from two sources, of which one is situated at Springhead and the other at Cottingham. The former place is some 4 miles to the west, and the latter about 5 miles to the north-west of Hull. The supply is constant

and averages 30 gallons per head per day for all purposes. The water of both sources is obtained from wells and borings in the chalk. The Springhead water is from a shaft, 22 feet in diameter and 72 feet deep, lined in its upper half with iron tubing. Two adits, one at a depth of 60 feet, the other at a depth of 72 feet from the surface, have been driven from the shaft in an easterly and in a westerly direction respectively. The eastern adit is 1,334 yards in length, and in connexion with it is a borehole 340 feet deep. The western adit is 1,716 yards in length, and in connexion with it are four boreholes varying from 300 feet to 400 feet in depth. Surface water is not known to be admitted to the Springhead supply; but the adits are not far distant from certain large cesspools, attached to houses in the neighbourhood and sunk in the chalk. The Cottingham source consists of three shafts each 80 feet in depth and lined throughout with iron cylinders. In connexion with these is an adit, driven in a northerly direction for a distance of 500 feet, and from which proceed three boreholes to a further depth of 200 feet. It is important, however, to note that at the surface of the chalk (40 feet from the surface of the ground) the iron lining of the shafts is freely perforated so as to allow of entrance into the wells of water on the surface of the chalk. Of this water there is a large quantity; and a rainstorm within a few hours raises largely the quantity of water obtained from the wells. Surface water therefore gains access to this supply and that, sometimes, to a very considerable extent.

There is no storage accommodation for water derived from either of these sources. The water pumped from each source passes directly, and without filtration, into mains, and these waters are mixed before distribution to the borough.

It is manifest, therefore, that neither of the sources is such as to give security that the water therefrom will at all times be absolutely pure and entirely free from danger to the health of consumers. At the same time the evidence I have given in the course of this report as regards manner of prevalence of choleraic disease, as well as of diarrhœa and enteric fever, in Hull in 1893, is not such as to afford ground for suspecting the water-supply of the borough as having played any appreciable part in the maintenance of any of these diseases in the district.

Sanitary Administration.—Before proceeding to describe the steps that were taken by the Sanitary Authority with a view to dealing with the outbreak of cholera in Hull, I summarise, as briefly as may be, the scheme of sanitary organisation of the borough for ordinary purposes.

The chief sanitary officer of Hull is the Medical Officer of Health, who has under his control the following staff:—

1 Deputy-Medical Officer of Health (who is engaged in practice).
1 Inspector of Nuisances.
4 Assistant Inspectors of Nuisances.
11 "sanitary officers."
5 Inspectors for special purposes (such as inspection of food, offensive trades, &c.).
16 drain-flushers.
16 whitewashers.
4 disinfectant distributors.
5 clerks.

The town, for purposes of sanitary administration, is divided into four districts. Each district is in charge of an assistant inspector, who has two or more "sanitary officers" under him. The assistant inspectors are

responsible to the Inspector of Nuisances, who is in turn responsible to the Medical Officer of Health. The staff of flushers and white-washers quoted in the list given is made use of in cleansing the poorer-class neighbourhoods. It is the duty of these officers to periodically flush out subsidiary drains and to whitewash the walls of courts, yards, and entries in certain districts allotted to them. It is also part of their duty to take the same steps in courts or yards where infectious disease is known to have occurred. The Sanitary Authority disinfect free of charge houses that have been invaded by infectious disease, and also all articles that have been exposed to infection. For the latter purpose high-pressure steam is employed. They have two hospitals for infectious diseases, one of which is a good building, constructed of brick, with accommodation for 150 patients; the other a wood and brick structure capable of accommodating 50 patients. In connexion with both hospitals there is spare ground sufficient for the erection of tents in case of need.

On the appearance of choleraic disease in the borough in 1893 the following steps were taken by the Sanitary Authority.

On September 5th circulars were issued to all medical men practising in Hull requesting them to notify to the Medical Officer of Health all cases of choleraic diarrhœa* that might come under their care, and intimating that the usual fee (2*s.* 6*d.*) would be paid for each notification. On the same date another circular was issued to medical practitioners stating that the Sanitary Authority would supply free of charge disinfectants to any person provided with an order (of which a number were enclosed for use). Stations (shown by yellow crosses on Map I.) were opened in various parts of Hull for distribution of disinfectants and of diarrhœa mixture. Placards were posted throughout the town, headed "Urgent Sanitary Precautions," and treating briefly of simple precautions as regards food and drink and of need for at once seeking medical advice in the event of attack by diarrhœa.

On September 4th a medical man was temporarily appointed to assist the Medical Officer of Health. To this work he was to give his whole time. He received a salary of 5*l.* 5*s.* per week with board and lodging. His engagement terminated on October 31st.

Each house notified as invaded by cholera, choleraic diarrhœa, or diarrhœa was forthwith visited by an officer of the Sanitary Authority. Cases of cholera or choleraic diarrhœa were taken to hospital if in a fit state for removal, and if this step were considered desirable. If the person attacked was not thus removed instructions, printed as well as verbal, were given to members of the invaded household regarding necessary sanitary precautions; and, after cleansing and disinfection of the privy and removal of its contents for cremation, a specially constructed pail was supplied by the Sanitary Authority to receive the bowel discharges. Until the medical attendant certified that infection had ceased this pail was removed daily by the Sanitary Authority and its contents burned in the Corporation destructor. These pails were also supplied to houses invaded by ordinary diarrhœa. Disinfection and cleansing of invaded houses, of infected articles, flushing of subsidiary drains, and whitewashing of courts, yards, and passages were resorted to in all cases of choleraic disease. Drains of houses known to be invaded by diarrhœa were in all cases flushed and disinfectants also

* On July 29th, the Sanitary Authority by circular requested medical practitioners to notify severe cases of diarrhœa to the Medical Officer of Health; but no fee was offered, and the request was not complied with.

supplied to the occupants gratis. Efforts were in all cases made to ascertain the source of infection; and members of households invaded by choleraic disease, as also persons who had recently had communication with these or who resided in their near neighbourhood, were as far as possible kept under observation for not less than one week in order that illness on the part of these persons might as soon as possible become known to the Sanitary Authority.

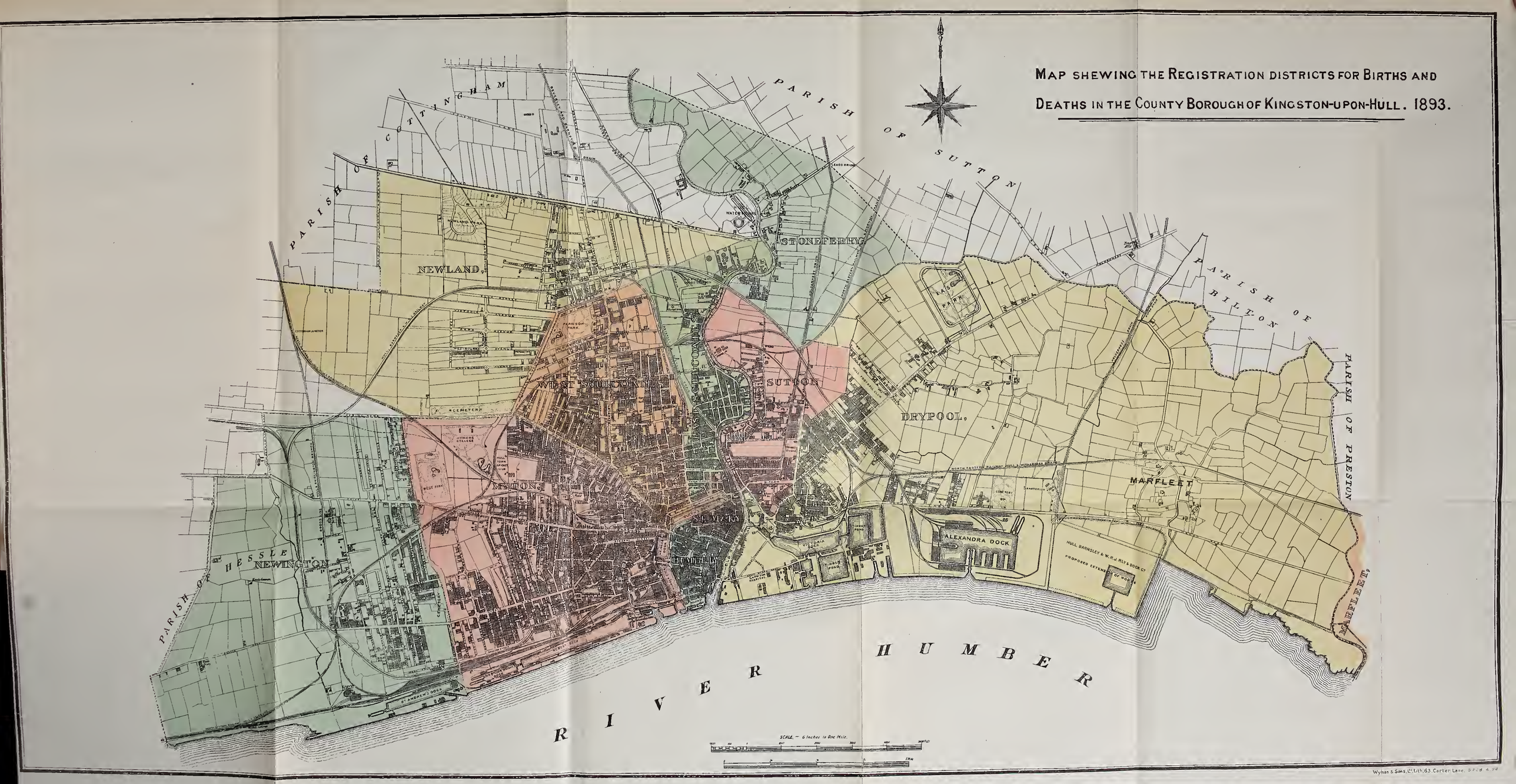
The arrangements, both general and special, which I have just described were carried out by the officers of the Sanitary Authority during the period of cholera prevalence with promptness and thoroughness in every instance that came under my observation. The sanitary organisation of Hull is good, and stood well the strain put upon it by the outbreak of choleraic disease in the borough. The weakest point in the administrative arrangements consists in the want of an Assistant Medical Officer to give his whole time to the work of aiding the Medical Officer of Health, who is also surgeon to the borough police, medical superintendent of both infectious diseases hospitals (where there is no resident medical officer), and Medical Officer of Health to the Port of Hull and Goole. This insufficiency of medical staff, which requires to be permanently remedied, was temporarily met by the appointment of such an assistant during the period of cholera prevalence.

Conclusion.

From the foregoing account it does not appear that disease of the nature of cholera was prevalent to any large extent in Hull in 1893. Its continued maintenance there, however, for several weeks, and the fact that it was accompanied by unusual amount of diarrhœa and of enteric fever, are circumstances that merit the serious attention of the Sanitary Authority. What evidence is to hand regarding the reason for this maintenance of cholera and unusual prevalence of diarrhœa and enteric fever, tends to point to their having been favoured by the existence of certain unwholesome conditions in connexion with the general sanitary circumstances, the sewerage and drainage arrangements, and the methods of removal and disposal of excrement and refuse in the town. To the amelioration of such of these conditions as are capable of improvement the Sanitary Authority should direct their efforts. Nor should they neglect careful inquiry into the nature of their water-supply, with the view of taking such steps as may ensure to the inhabitants of the district in their charge an ample supply of water uniformly of undoubted purity. Although, as I have stated, nothing in the course of my inquiry transpired tending to throw on water suspicion of its having played an appreciable part in maintenance of cholera or other disease in the borough, yet certain circumstances in connexion with the sources from which this supply is derived are of a sort to suggest that this water is less completely secured than is desirable against conditions that might possibly involve danger to the health of the inhabitants of Hull.

The steps taken by the Sanitary Authority in dealing with cholera I have already favourably commented on; and to this action of the Authority may, I think, with some justice be attributed the limited amount of this disease in their district in 1893.

MAP I.
MAP OF THE SEVERAL REGISTRATION SUB-DISTRICTS OF HULL;
Showing the distribution of Cholera, Choleraic Diarrhoea, and Diarrhoea in the borough in certain weeks of 1893; and indicating the Hospitals, Mortuaries, and Cholera Burying Grounds, as also the Depôts whereat "Diarrhoea Mixture" and "Disinfectants" were obtainable during the Cholera Seasons.
Each represents an attack by Cholera.
" a death from "
" an attack by Choleraic Diarrhoea.
" " " Diarrhoea.
" a Hospital.
" " Station whereat "Diarrhoea Mixture" and "Disinfectants" were obtainable.
" represents a Cholera burying ground.
" " Mortuary.
The distribution of Cholera and Choleraic Diarrhoea is shown for the period August 24th to October 12th (inclusive:) the distribution of Diarrhoea is shown for the period September 7th to October 12th (inclusive.)
NEWLAND
STONEFERRY
WEST SCULCOATES
SUTTON
DRYPOOL
MARFLEET
NEWINGTON
ALEXANDRA DOCK
RIVER HUMBER
SCALE, — 3 Inches to One Mile
Wyman & Sons, Ltd. Lith. 63, Carter Lane.



Wyman & Sons, Ltd. Lith. 63, Carter Lane.

MAP II.

MAP OF THE SEVERAL REGISTRATION SUB-DISTRICTS OF HULL;

Shewing the distribution of Enteric Fever in the borough during 1893.

Each ● represents a certified case of Enteric Fever.

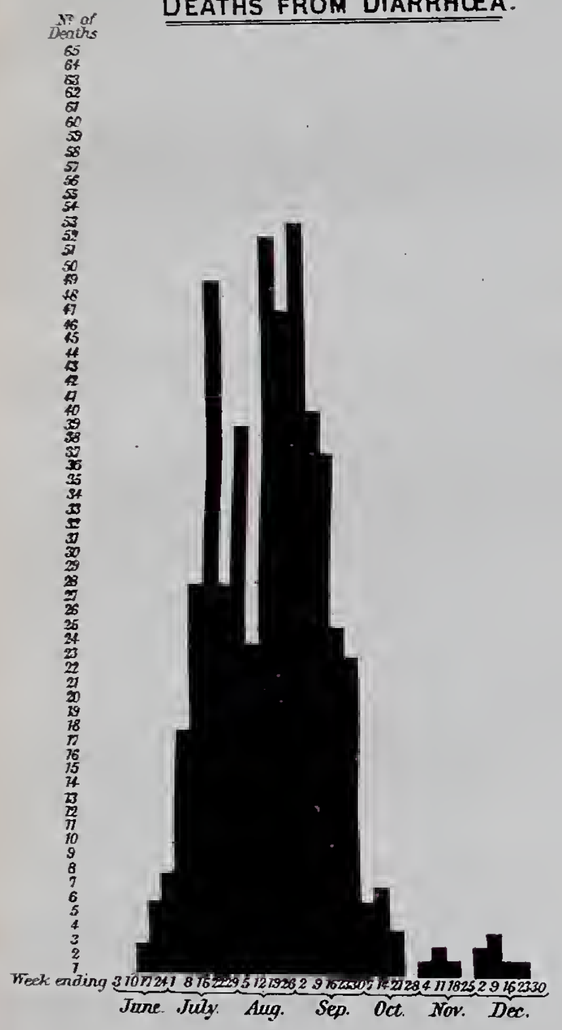
Wyman & Sons, Ltd. Lith. 63, Carter Lane. E.C.

Borough of Hull.

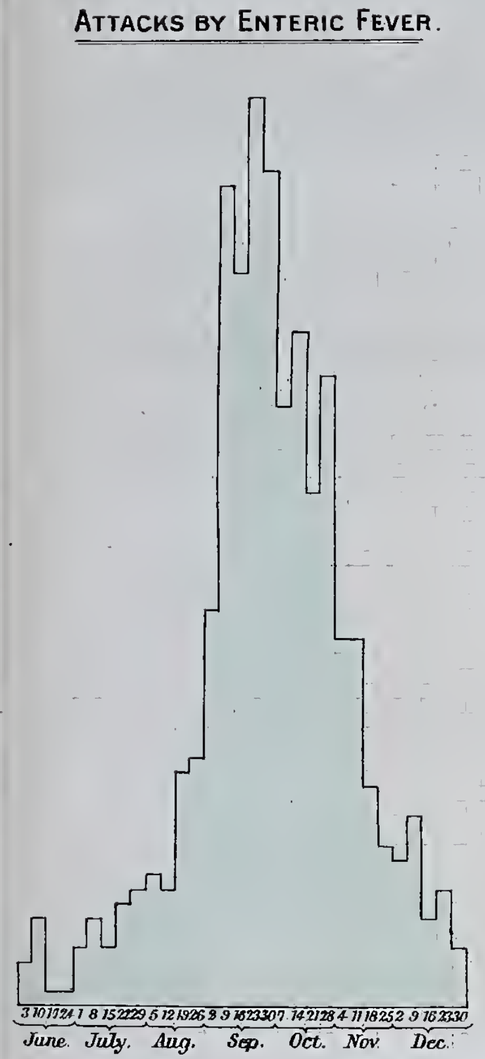
DIAGRAM. *Showing week by week from June to December 1893, the number of deaths reffered to Cholera (inclusive of Choleraic Diarrhœa) and to Diarrhœa: and showing also in like fashion, the number of persons ascertained to have been attacked by Cholera (inclusive of Choleraic Diarrhœa) and by Enteric Fever.*

- *Represents a Death from Cholera (inclusive of Choleraic Diarrhœa.)*
- *Represents an attack by Cholera (inclusive of Choleraic Diarrhœa.)*
- *Indicates weeks wherein the number of attacks was probably considerably in excess of those recorded.*
- *Represents an attack from Enteric Fever.*
- *" " a Death by Diarrhœa.*

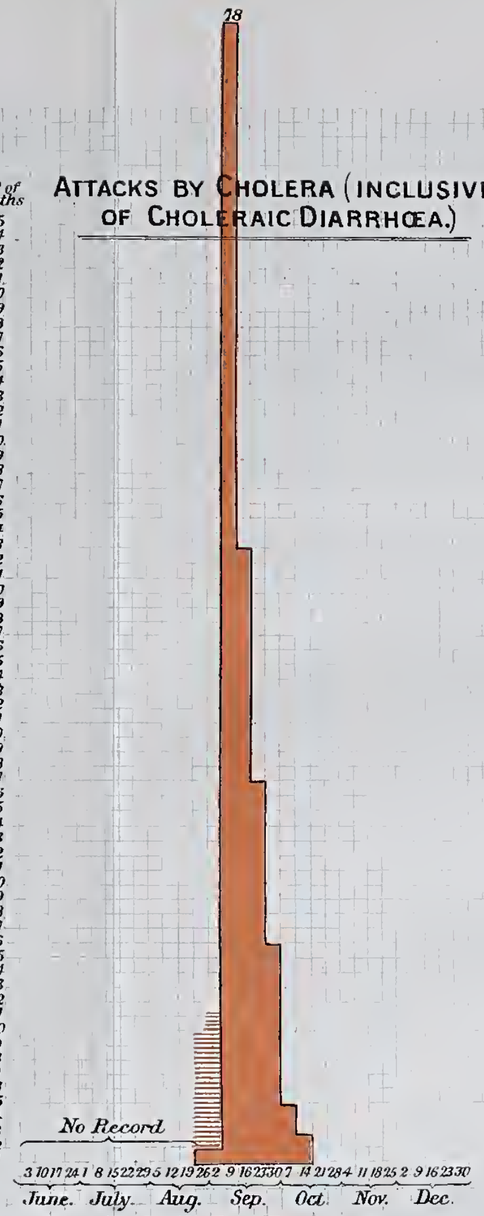
Deaths from Diarrhœa.



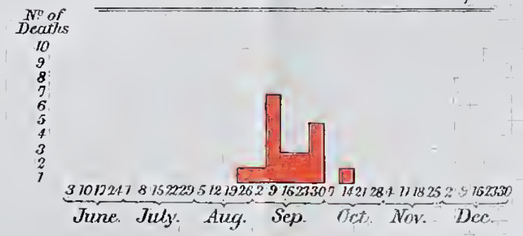
Attacks by Enteric Fever.



Attacks by Cholera (inclusive of Choleraic Diarrhœa.)



Deaths from Cholera (inclusive of Choleraic Diarrhœa)



Wyman & Sons, Ltd. Lith. 6380. 10.93.

No. 4.

Report on Cholera in the Borough of Rotherham in 1893; by Dr. Theodore Thomson.

On September 5th, 1893, the Board received from the Medical Officer of Health of the Borough of Rotherham a telegram stating that on that day a case believed to be Asiatic cholera had occurred in his district, and that the person thus attacked had succumbed to the disease. Communication hereupon took place by telegram between the Board and the Medical Officer of Health as to steps to be taken with the view of definitely ascertaining the true nature of this person's malady; and in consequence a portion of the lower bowel (ileum) of the deceased was on the 6th September forwarded to Dr. Klein for bacterioscopic examination. As a result of Dr. Klein's investigations it appeared (7th of September) that the case was indistinguishable from true cholera; and I was accordingly instructed to proceed forthwith to Rotherham for the purpose of making inquiry into the circumstances attendant on the illness of the deceased, and to report also as regards the steps that were being taken by the Sanitary Authority with the view of preventing spread of cholera. I arrived in Rotherham on September 8th, and from inquiries made then, and subsequently, ascertained the following facts.

William B., collier, 35 years of age, residing in Tummon Street, Masbro' (in the borough of Rotherham), was in his usual health on September 4th. On the morning of September 5th he rose at 5 o'clock and had a loose motion. Afterwards he partook of breakfast as usual, and at 8 o'clock set out with a friend on a fishing expedition to a neighbouring stream. On the way he was attacked with vomiting and diarrhœa, but nevertheless continued his journey. On the banks of the stream he was seized with severe diarrhœa, vomiting and cramps, so that he had to be conveyed home in a cart. He reached home about 2 p.m., and was there seen by a medical man shortly afterwards. He was then, it is stated, in a condition of collapse, with pulse imperceptible at the wrist, extremities cold, face pinched and dark in colour. There was no further sickness or diarrhœa after he reached home; but the condition of collapse continued, and he died at 7 p.m.

Subsequently the following cases certified as cholera by their medical attendants occurred in the borough.

On September 11th: John W., Arthur Street, aged 50 years.

On October 18th: George N., Sales Yard, aged 39.

The clinical features of the first of these two cases were as follows:—Severe cramps in the abdomen and in the extremities, vomiting, frequent rice-water stools, cold and dusky skin, feeble voice, diminution of urinary secretion, pulse at wrist imperceptible. Death occurred 26 hours after seizure. The symptoms observed in the second case were severe cramps, sickness, and copious rice-water stools. In this instance recovery ensued.

In all, therefore, three cases certified as cholera are known to have occurred in the autumn of 1893 in the borough; and of these three two had a fatal result. There was no localisation of the disease in any particular portion of the district; the residences of these three persons were widely separate.

In addition, however, to these cases certified as cholera there occurred in Rotherham other 18 cases certified as "choleraic diarrhœa." The distribution of these in time was as follows:—

On September	15th	were notified	4	cases.
,, ,,	18th	was ,,	1	case.
,, ,,	19th	were ,,	2	cases.
,, ,,	20th	,, ,,	2	,,
,, ,,	24th	was ,,	1	case.
,, ,,	26th	,, ,,	1	,,
,, October	2nd	,, ,,	1	,,
,, ,,	6th	,, ,,	1	,,
,, ,,	7th	,, ,,	1	,,
,, ,,	9th	were ,,	2	cases.
,, ,,	14th	was ,,	1	case.
,, ,,	18th	,, ,,	1	,,
Total		- -	18	cases.

As regarded two only out of these 18 persons attacked by choleraic diarrhœa was bacterioscopic examination of stools (by Dr. Sims Woodhead) resorted to; but with the result that both cases were declared indistinguishable from true cholera. These two were notified (as choleraic diarrhœa) on October 2nd and October 6th respectively. With the single exception of the case notified on October 6th, which proved fatal, all the notified cases of choleraic diarrhœa recovered. Of these 18 cases, 15 were between the ages of 25 and 60, two between the ages of 5 and 14, and one was 1 year of age. There was no exceptional incidence of this "choleraic diarrhœa" on any one part of Rotherham; the cases were, on the contrary, scattered throughout the district with tolerable equality.

In view of this cholera and "choleraic" diarrhœa in Rotherham in 1893, it becomes of interest to note also the amount of illness designated as diarrhœa which existed in the district in that year. And first as to the number of *deaths* attributed to this cause in Rotherham during the second and third quarters of 1893. Of these there were 85, a number which is in excess of the total deaths from this cause in Rotherham in any complete year during the preceding decade. The appended table (Table I.) affords means of comparing year by year the death-rates in Rotherham from diarrhœa during the period 1883–93, and also allows contrast of the Rotherham diarrhœa death-rates with those of the 28 large towns.

Table I.

Showing the Number of Deaths referred to Diarrhœa in Rotherham during each of the Ten Years 1883–92, and in the Second and Third Quarters of 1893, together with the resulting Death-rates per Thousand living in each instance. For purposes of comparison the Death-rate yearly from the same cause in 28 large Towns during the same period is added.

Year.	Rotherham.				28 Large Towns.	
	Population.	No. of Deaths from Diarrhœa.	Death-rate per Annum from Diarrhœa per 1,000 living.	Diarrhœa Death-rate in Period 1883–92.	Death-rate per 1,000 from Diarrhœa. In each of the Years 1883–92.	Death-rate per 1,000 from Diarrhœa. 1883–92.
1883 - -	36,301	8	0·22	0·88	0·77	0·82
1884 - -	36,998	42	1·14		1·21	
1885 - -	37,707	29	0·77		0·69	
1886 - -	38,431	41	1·07		0·97	
1887 - -	39,168	42	1·07		0·97	
1888 - -	39,920	21	0·53		0·60	
1889 - -	40,685	66	1·62		0·82	
1890 - -	41,466	40	0·96		0·77	
1891 -	42,261	37	0·87		0·67	
1892 - -	43,072	22	0·51		0·70†	
Second and third quarters of 1893.	43,898	85	1·94*		1·07†	

* This is the rate per 1,000 living calculated not for the whole year, but for six months only.
† This rate is calculated on 33 large towns, not on 28 large towns, as in the remainder of the column.

From these figures it appears that during the decade 1883–92 the death-rate from diarrhœa in Rotherham was slightly in excess of the death-rate from the same cause in the 28 large towns during that period. Also it appears that the Rotherham diarrhœa death-rate exceeded the average annual rate for that town, in 1884, 1886, 1887, 1889, 1890, and again in 1893. Prior to 1893 the highest point reached by the rate was in 1889, when it was 1·62 per thousand per annum. But in 1893 the rate is seen to be considerably in excess of this, inasmuch as it is 1·94 per thousand for a period of six months only. It is true that within that period fall those portions of the year during which diarrhœa most prevails; nevertheless, the figures for the whole year will, it may safely be assumed, give a rate at least somewhat in excess of that quoted. The death-rate from diarrhœa in the country generally, however, was in the summer of 1893 above the average; and, accordingly, I append a table (Table II.), which affords means of comparing the death-rate from this cause in the borough of Rotherham with that from the same cause in the large towns and in England and Wales in the second and third quarters of 1893.

Table II.

Showing the Diarrhœa Death-rate per Thousand Persons living per annum in Rotherham, in 33 large Towns, in 67 other large Towns, and in England and Wales in the Second and Third Quarters of 1893.

Area.	Second Quarter, 1893. Diarrhœa Death-rate per 1,000 per Annum.	Third Quarter, 1893. Diarrhœa Death-rate per 1,000 per Annum.
Rotherham - - -	1·02	6·74
33 large towns - -	0·81	3·5
67 other large towns - -	0·61	3·8
England and Wales - -	0·52	2·8

From these figures it appears that both in the second and in the third quarter of 1893 the death-rate from diarrhœa in Rotherham was far higher than in the large towns or in England and Wales; indeed in the third quarter the death-rate in Rotherham was nearly twice as heavy as the mean rate of other towns. There was, therefore, not only an exceptionally heavy diarrhœa death-rate in Rotherham in 1893 as compared with its own previous records, but also as compared with the rates of the large towns and of the country generally for the second and third quarters of that year.

In the absence of returns of *cases* of diarrhœa—which is not one of the diseases scheduled by Rotherham for compulsory notification—no definite information is forthcoming as to the number of persons attacked by this malady during the whole of the period embracing the second and third quarters of 1893. But, after the appearance of cholera in the place, the Town Council of Rotherham requested the members of the medical profession practising in the borough to notify for the time being all cases of diarrhœa that they were called on to attend; and accordingly I am in this way able to give a list of the number of cases of diarrhœa that came to the knowledge of the Sanitary Authority from September 10th to October 31st. This information is supplied in the following table (Table III.):—

Table III.

Showing the Number of Cases of Diarrhœa notified in Rotherham Day by Day during the Period September 10th to October 31st, 1893.

1893.		1893.		1893.	
September 10 -	13	September 28 -	5	October 16 -	4
„ 11 -	30	„ 29 -	2	„ 17 -	1
„ 12 -	39	„ 30 -	1	„ 18 -	4
„ 13 -	10	October 1 -	0	„ 19 -	4
„ 14 -	18	„ 2 -	8	„ 20 -	2
„ 15 -	25	„ 3 -	8	„ 21 -	1
„ 16 -	15	„ 4 -	4	„ 22 -	9
„ 17 -	4	„ 5 -	3	„ 23 -	1
„ 18 -	14	„ 6 -	12	„ 24 -	7
„ 19 -	18	„ 7 -	3	„ 25 -	8
„ 20 -	25	„ 8 -	1	„ 26 -	3
„ 21 -	11	„ 9 -	4	„ 27 -	1
„ 22 -	9	„ 10 -	8	„ 28 -	0
„ 23 -	5	„ 11 -	2	„ 29 -	6
„ 24 -	1	„ 12 -	4	„ 30 -	9
„ 25 -	2	„ 13 -	3	„ 31 -	3
„ 26 -	15	„ 14 -	0		
„ 27 -	10	„ 15 -	7	Total -	402

Comparison of the figures in this table with those given on page 1 regarding "choleraic" diarrhœa, shows that the period at which the latter was most prevalent was also that at which diarrhœa cases were most numerous. Thus during the 11 days September 10th to 20th half the known cases of choleraic diarrhœa were notified, while during the same period 211 out of the 402 cases in Table III. were notified.

Notwithstanding this coincidence,— which might be thought of as lending support to a thesis that this excessive diarrhœa prevalence had had relation to the presence of cholera in the district,*—analysis of the ages of persons attacked by, or dead of, diarrhœa does not go to show that there was in Rotherham in 1893 any departure from the type of summer diarrhœa usually seen in this country. In the following table (Table IV.) the *deaths* attributed to diarrhœa in Rotherham in each of the ten years 1883–92 and in the second and third quarters of 1893 are classified according to age.

Table IV.

Showing Year by Year for the Ten Years 1883–92, and for the Second and Third Quarters of 1893, the Number of Deaths in Rotherham attributed to Diarrhœa, classified according to their Ages.

Year.	No. of Deaths at all Ages.	No. of Deaths of Persons over 60 Years of Age.	No. of Deaths of Persons 25–60 Years of Age.	No. of Deaths of Persons 15–25 Years of Age.	No. of Deaths of Persons 5–15 Years of Age.	No. of Deaths of Persons 1–5 Years of Age.	No. of Deaths of Persons under 1 Year of Age.
1883	8	—	—	1	—	—	7
1884	42	2	—	—	1	10	29
1885	29	3	—	—	—	6	20
1886	41	2	2	—	—	8	29
1887	42	3	2	—	—	8	29
1888	21	6	2	1	—	8	9
1889	66	2	4	—	—	12	48
1890	40	3	—	—	1	8	28
1891	37	2	—	1	—	2	32
1892	22	—	2	—	—	3	17
2nd and 3rd quarters of 1893.	85	4	—	—	—	24	57

* It should be borne in mind that the absence of definite information as to amount of diarrhœa *attacks* in Rotherham, prior to September 10th, materially limits the value of the data given in Table III.: that, indeed, diarrhœa attacks may have been more numerous prior to September 10th than any time in September or October. As matter of fact the amount of *deaths* from diarrhœa in Rotherham was greater in both July and August than in September.

From the figures of Table IV. it will be perceived that the age distribution of diarrhœa deaths usually observed in this country was not departed from in Rotherham in the second and third quarters of 1893. As in other years deaths from this cause were most abundant under five years of age, and next at ages over 60; indeed in these two quarters of 1893 all the deaths attributed to diarrhœa in Rotherham were included within those age groups.

Inquiry was also made as regards the incidence of diarrhœa *attacks* on certain age-groups. No definite conclusions, however, were permissible on the figures when formulated; partly because of the brief period during which cases of diarrhœa were being notified, with consequent small range of facts acquired; and partly because of the absence of reliable standard data of similar sort which would afford means of comparison with the Rotherham figures. Nevertheless, it may be noted that the incidence of known diarrhœa attacks in Rotherham in 1893 was, as elsewhere, found mainly on the very young. In a general way, therefore, the age-distribution of diarrhœa attacks coincided with the age-distribution of deaths from this malady; and the balance of evidence went to indicate that in Rotherham in 1893 diarrhœa did not appreciably depart from the usual type of summer diarrhœa in this country.

Further, there was no special incidence of the diarrhœa on any particular locality, whether judged of by distribution of deaths in the second and third quarters, or by distribution of the attacks known to have occurred from September 10th to October 31st.

With reference to the question of possible parallelism in this district during 1893 of diarrhœal diseases and enteric fever, I was able, enteric fever being among the diseases notified in the borough, to obtain a statement of the cases notified from January 1st to November 15th, 1893; and with result as follows:—

January:	Number of cases of enteric fever notified			- 2
February:	,,	,,	,,	- 3
March:	,,	,,	,,	- 5
April:	,,	,,	,,	- 3
May:	,,	,,	,,	- 3
June:	,,	,,	,,	- 4
July:	,,	,,	,,	- 5
August:	,,	,,	,,	- 6
September:	,,	,,	,,	- 11
October:	,,	,,	,,	- 13
November 1st to 15th		,,	,,	- 4
		Total	- -	- 59

From these figures it is evident that although there was no exceptional prevalence of enteric fever in Rotherham in 1893, yet such as occurred was in the main coincident in time with the observed major incidence of choleraic disease. But as with choleraic disease and with diarrhœa, so also with enteric fever, there was no exceptional prevalence in any particular locality of the district.

Causation of the Choleraic Outbreak.

In searching for a cause of cholera in Rotherham, attention was in the first instance directed towards ascertaining in what way the disease might have been imported into the town. To this end careful inquiry was made into the habits and previous movements of the person

attacked on September 5th, who was the first recognised case of cholera in the borough. But investigations in this sense failed to reveal that this man had, on any occasion during several weeks preceding his attack, been out of Rotherham or its immediate neighbourhood; or that anyone other than inhabitants of the district had during that period visited his residence. Especially were inquiries made as to whether he had, during certain days antecedent to his attack, visited any place where cholera was known or suspected to exist; and as to whether he had had any sort of relation, direct or indirect, with any person who had suffered from illness bearing suspicious resemblance to cholera. But all evidence obtained on these points was of a negative character. It did not appear that he had visited any locality where choleraic disease existed; and no fact was ascertained tending to show that he had received any article by which cholera infection might possibly have been conveyed to him. It could not be discovered that he had, during days immediately preceding September 5th, partaken of any article of food or drink as to which there were grounds for suspecting that it might have served as medium of introduction of the disease.

In default of affirmative evidence on these points, search was made for cases of cholera unrecognised but existing in Rotherham prior to September 5th. These inquiries resulted in the discovery of the fact that a woman named Mary B., aged 29, residing in Clough Road, Rotherham, died on August 24th, after a few hours' illness, the symptoms of which are stated to have been abdominal pains and collapse, without sickness or diarrhœa. The medical attendant, who saw her for a few moments only and when she was already moribund, certified the death as having been "due to natural causes." This woman had, with several friends, spent the preceding day (August 23rd) at Grimsby and Cleethorpes, where cholera was then occurring. Of the party she alone had partaken of oysters on the sands at Cleethorpes. With the exception of this woman, no person was discovered to have suffered from any malady showing symptoms which there was any ground at all for attributing to cholera. The woman in question resided in a house some 500 yards distant from that inhabited by the man attacked on September 5th; but there does not appear to have been any communication between the two households.

So, too, as regards the question of subsequent maintenance of the disease in Rotherham having been due to personal communication. Negative results were obtained on inquiry into the circumstances of the cholera cases that afterwards occurred in the district. In the instance of all cases of cholera, and almost all cases of choleraic diarrhœa, there was no evidence of communication between members of invaded households.

In the absence of data pointing to maintenance of the disease by personal communication, the other conditions, which might have had concern with the cholera and choleraic diarrhœa witnessed, were in turn considered. In this way were passed in review the general sanitary circumstances of the district, the sewerage and drainage of the borough, the methods there adopted for disposal and removal of excrement and refuse, and, in addition, the milk supply and the water service.

General Sanitary Circumstances of the District.—The town of Rotherham is for the most part situated on hilly ground, draining to the Rivers Don and Rother, by which it is intersected. It lies on the Middle Coal Measures, with a considerable amount of rock approaching near to or cropping out on the surface; only alongside the Don and the Rother is found alluvial deposit. The soil immediately overlying the coal measures and rock is, to a degree greater than is the case in many other towns, exposed to fouling. This exceptional liability to fouling

is due to soakage from privy middens. The inhabited dwellings in Rotherham are mostly working class houses, and in fairly good condition. Save for the pollution of the soil by leaky privy middens, the general sanitary circumstances of Rotherham are fairly good, and are not of a nature to distinctly favour dissemination of cholera.

The Sewerage and Drainage arrangements of Rotherham are for the most part satisfactory. In large majority the sewers are well constructed, have a proper gradient, and are provided with sufficient means of ventilation. One area only, of small size, is unsewered, and drains into cesspools and into the River Don. House drains are in most instances properly constructed of sanitary pipes. The ventilation of these, however, is not infrequently insufficient. Almost all yard and sink pipe gullies are trapped, and sink pipe and other waste water pipes are, in the vast majority of cases, disconnected from the drains to which they discharge.

These facts are not such as to encourage the thesis that in Rotherham infection by sewers may have been the mode of propagation of diarrhœal disease; and in further contradiction of such an hypothesis, it is to be noted that there was no exceptional incidence of cholera, choleraic diarrhœa, or diarrhœa along the line of any particular sewer or sewers.

Excrement and Refuse Disposal and Removal.—The prevailing system of excrement and refuse disposal in Rotherham is the privy midden, the pit of which is usually sunk 2 or 3 feet below the ground level. The contents of these middens are often wet, and, from the structure of the pit, are frequently liable to percolate into and foul the surrounding soil. In the comparatively few instances where water-closets have been constructed, house refuse is stored in moveable receptacles or in brick ash-pits. Excrement and house refuse are in part disposed of to neighbouring farmers, and in part incinerated by a destructor.

In the midden system above described there is nothing, apart from the indirect effect of soil pollution by leakage from privy middens, tending to suggest connexion between this method of excrement and refuse disposal and the appearance of cholera in the district. It must not be overlooked, however, that leaky privy middens would not only pollute the ground on which the town stands, but would also, in the event of their contents becoming specifically infected by cholera excreta, transmit this contagium to the surrounding soil, where it might multiply and be in various ways conveyed throughout the district. That cholera was thus fostered in Rotherham in 1893 is not affirmed; there is no positive evidence on the subject. But this danger nevertheless exists, and should not, as I have said, be lost sight of.

The Sources of the Milk Supply to houses invaded by cholera, choleraic diarrhœa, and diarrhœa were duly ascertained, but nothing appeared tending to throw suspicion on any one supply.

The Water Service of Rotherham still remains to a great extent in the unsatisfactory condition described by me in my report on an outbreak of enteric fever in that and in two neighbouring districts in 1891. Notably the Wellgate Spring, a water of which the quality is open to the gravest suspicion, still formed, at the date of appearance of cholera in that place, part of the public water service of the borough.

Notwithstanding, however, the unsatisfactory nature of this supply as a whole, it does not appear to have been a dominant factor in the dissemination of cholera and choleraic diarrhœa in the district. For there are within the borough two areas of water supply, known as the "high level" area and the "low level" area, each with a population of something over 20,000. These two areas are supplied by water taken

from different sources, one of which is decidedly more unsatisfactory than the other; and upon the assumption that water had acted as the medium of propagation of the disease, exceptional incidence was perhaps to be looked for in that one of the two districts of which the water supply was most liable to become specifically polluted. This, however, was not the case; there was, indeed, almost equal incidence of cholera, choleraic diarrhœa, and diarrhœa in the persons inhabiting the "high level" and "low level" areas of water supply. This fact does not absolutely exclude water as a causative agent, but is undoubtedly in favour of the thesis that water had no important concern with the cholera, choleraic diarrhœa, or diarrhœa witnessed.

Action taken by the Sanitary Authority.

The Sanitary Authority displayed commendable promptitude and energy in dealing with cholera when it appeared in their district. A ward block in the Borough Hospital for Infectious Diseases was set apart for the isolation of persons attacked by cholera or choleraic diarrhœa; while another ward block was reserved for the reception of unattacked members of invaded households, in order that these persons might for a time be kept under observation. All articles that had been exposed to infection of cholera were either destroyed or disinfected by steam under pressure; invaded houses were fumigated with sulphur, their wall-papers stripped off, and the walls, floors, and woodwork of the dwelling washed with a strong solution of carbolic acid. The drains of invaded houses were tested and subsequently well flushed. In the event of unattacked inhabitants of invaded dwellings not accepting the offer of shelter at the Borough Hospital, their houses were daily visited by officers of the Sanitary Authority for some time after invasion, in order that the health of the remaining members of the household might be watched. All houses in the immediate neighbourhood of an invaded dwelling were visited by officers of the Sanitary Authority, who made inquiry as to the past and present health of the occupants. These steps were also taken with regard to members of all households in other parts of the borough who had recently visited or been visited by members of an invaded family.

In addition to the foregoing precautions, adopted consequent on the occurrence of each case of choleraic disease, the Sanitary Authority made the following arrangements. A circular was issued (on September 9th) by the Town Clerk of Rotherham to all medical men practising within the borough, requesting them to notify immediately to the Medical Officer of Health (with statement as to age of person attacked) any case of diarrhœa that might come under their attention, and intimating that the ordinary notification fee (2*s.* 6*d.*) would be paid for each diarrhœa case notified. On September 11th a further circular was issued by the Medical Officer of Health to medical practitioners enclosing a number of orders for gratuitous supply of disinfectants to be furnished by the Sanitary Authority. This second circular requested each practitioner to give these orders to such of his patients as should, in his opinion, have need for use of disinfectants. On the same date were printed placards setting forth sundry "urgent sanitary precautions" to be taken in the then emergency. These placards, to the number of 250, were posted throughout the town, but more particularly in courts and alleys. Arrangements were also made to ensure the visiting, immediately on receipt of notification, of every house invaded by cholera, choleraic diarrhœa, or diarrhœa, by an officer of the Sanitary Authority, whose duty it was to see that in every instance proper steps were taken in dealing with these diseases.

It would appear then as a result of this investigation that the cholera in Rotherham in 1893 was of but brief duration. Also that it was of small amount, unless indeed the coincident prevalence of diarrhœa, which was exceptionally great, is to be considered as in some sort related to the choleraic disease. No satisfactory evidence was obtainable as to the date at which cholera first invaded the district, or as to the manner in which it was introduced. Equally indefinite is the information respecting the means by which the disease was maintained in Rotherham subsequent to the occurrence of the first known case.

But, though the results of inquiry as to the origin and maintenance of cholera in Rotherham be indefinite and unsatisfactory, the lessons to be learned by the Sanitary Authority are not the less of importance or less deserving of serious attention. It is clear that the sanitary condition and organisation of a district must be of a high order to enable the Local Authority to successfully cope with a malady which may appear one knows not certainly whence, and be maintained one knows not certainly how. To the sanitary organisation of Rotherham I have already referred favourably; it is, indeed, susceptible of improvement, but stands less in need of reform than does the sanitary condition of the district. In two respects particularly does the latter call for unfavourable comment. One of these is the fouling of the ground on which the town stands; fouling which must of necessity be inseparable from existence within the borough of numbers of wet and leaky privy middens. The other is the unsatisfactory nature of the public water supply. That this supply should be in part derived from gathering grounds of which the conditions are such as to render possible dangerous pollution of the water thence collected, is a matter of great gravity. But that a supplementary source of this supply should be a spring, which rises in the very centre of the town and, therefore, emerges through a soil polluted by the contents of privy middens, is a condition of distinctly perilous sort. Rotherham had in 1891 actual experience of loss of life and health from fever due to specific pollution of the public water supply; but the Sanitary Authority do not appear to have profited by the lesson. In 1893 cholera made its appearance in the district, but fortunately did not, as was formerly the case with enteric fever, obtain intimate relation with the public water supply. In this there was for the Sanitary Authority matter of congratulation; but there should also be food for reflection. Let them consider seriously the responsibility for lives lost and health destroyed that will be theirs should the lesson of 1891 be repeated in 1894 with cholera in place of enteric fever as the polluting agent of the public water supply of the district confided to their charge.

No. 5.

Report upon certain certified Cases of Cholera in the Middleton Urban Sanitary District; by Dr. R. Deane Sweeting.

In conformity with instructions, I made inquiry on September 12th, 1893, with respect to certain alleged cases of cholera at Middleton, situated some 12 miles north of Manchester (population in 1891 of Middleton Urban Sanitary District, 22,162; of Middleton Parish, 11,694).

The first case to which my attention was directed was that of Mrs. G., aged 64, a publican's widow living at the "Old Hall Inn." She was said to have been subject to occasional attacks of diarrhœa, and had had slight diarrhœa more or less all the week before the onset of her fatal illness. This began at noon on September 4th with profuse purging and some griping pain. Between then and 10 p.m. her bowels were evacuated 40 times. During the night she had cramps in the legs and vomiting; her feet and hands were blue and her eyes were sunken.

The practitioner who attended her stated that when called to her at 3 a.m. on September 5th he found her with "crampy pains" in the legs and lower part of the abdomen. She had profuse diarrhœa and excessive vomiting. He saw none of the stools; but her stockings and the bed were soaked with watery inodorous evacuations. She was cold, and her temperature was sub-normal (below 95°). She spoke in a whispering raucous voice. The skin of the extremities was shrivelled and "mahogany colour." She had passed no water since the diarrhœa set in. Death ensued at noon on September 5th, and was certified as "choleraic diarrhœa, 14 hours."

The deceased served in the bar of the inn. No customers that she had served had been noticed to be ill. Now and then tramps came to the bar, but none of them had been observed to be suffering from any disease. She seldom ate cockles or mussels, and rarely partook of fish. The family had some fish a few days before her illness, but as none of the others who had shared her food had been ill, I did not inquire further into this. I could discover no kind of connexion with antecedent cholera at Hull, Grimsby, Rotherham, or any other place. Neither was there any known relation to a fatal case of "choleraic diarrhœa" which occurred in Middleton on August 27th, and which will be again mentioned. She had no unusual food during the few days preceding her attack, and what she had was shared by others who escaped.

"Old Hall" Inn consists of seven rooms, three of them belonging to the bar; the remainder were occupied by six persons. There is a narrow confined backyard attached to the house. This is badly paved and contains untrapped gullies, a foul urinal and a particularly offensive large open midden privy. The external wall of the scullery abutting on the yard is conspicuously damp, probably from old leakage of the sink pipe passing through it. Water is supplied from the public service of Middleton.

The second case was that of Mrs. C., aged 70, of 12, Chapel Street. She was a feeble, weakly woman, "hardly able to creep about," and is said to have been very subject to diarrhœa. She often suffered from this, and "the least thing set her going." On September 6th at 8 p.m. she was taken

with diarrhœa and cramps in the legs and hands. She did not complain of any pain in the stomach; but there was some vomiting, and also slight blueness of the feet and hands. At 10.30 a.m. on September 7th, she was seen by Dr. Graham (the Medical Officer of Health) and appeared to be in a state of collapse. Death occurred at 11.30 a.m., being certified as "cholera—12 hours."

I could learn of no connexion between this case and cholera in any of the already infected towns. Neither could I obtain evidence of any unwholesome food that she had eaten. In point of fact, she ate exceedingly little, usually only potato and gravy for her dinner.

It was, however, alleged that Mrs. C. had contracted disease by laying out Mrs. G., and I made particular inquiry into this matter. I learnt that she was present in Mrs. G.'s house during the preparations for interment; although it is not known that she herself took any actual part in the proceedings, which were performed by two other women neighbours and the joiner who made the coffin. Mrs. C. sickened 32 hours after the death of M. G. I saw the two other women, who were in apparently perfect health; the joiner who was away on holiday at the time of my visit was also stated to be in good health.

No. 12, Chapel Street, is a four-roomed house in a terrace, occupied by four people. The sanitary circumstances, including the provision of the public water service, are good. The waste pipes are cut off, the gullies trapped; whilst the contents of the pail provided for excrement and the separate dust-bin are said to be weekly removed.

These two fatal cases had been rapidly interred. It was consequently impossible to procure for examination any of the intestine or any stools or discharges.

The third case was that of Mrs. S., aged 44, of 17, Market Street. She was attacked on Friday night, September 8th, with vomiting and purging. She had during the night some cramps in the legs, but very little pain in the belly. The vomiting ceased on Sunday morning, September 10th, the purging on Monday night, September 11th, and the patient at the time of my visit was convalescent. This patient was first seen by an unqualified assistant to a medical man in Middleton on September 9th at 5 a.m. She then had cramps in the legs, toes, hands, and lower part of the abdomen. There were excessive diarrhœa of a watery character, vomiting, and a subnormal temperature (97° 2). Her eyes were sunken, her pupils contracted, and there was cold, clammy, perspiration on her face.

The medical man himself eventually saw this case, and notified it to the Medical Officer of Health on September 11th as "cholera." At the time of my visit he was away from home on holiday; but I procured his address, and telegraphed to him to ask whether he considered the case to have been one of "English" or of "Asiatic" cholera. He replied that he regarded it to be "English cholera."

I could not ascertain in this case any relation to antecedent cholera outside Middleton. Neither could I gain information as to any unwholesome food having been partaken; she had had "chip" potatoes for supper before going to bed on Friday, and "beefsteak-pie" for dinner on Thursday; but all the other members of her family had partaken of these articles as well, and none of them had been affected.

Having ascertained that Mrs. S. had been in attendance on Mrs. C., I procured the following information as to her movements. Mrs. S. went to the house of Mrs. C., but arrived too late to be of any service, Mrs. C. being already dead, and her body laid out. I saw two other women who did lay her out, and found them quite well. But the Sanitary Inspector informed me that he saw Mrs. S. emptying the flock bed

used by Mrs. C. in Mrs. C.'s backyard, after the decease of that person. The bed was saturated with discharges, and the Inspector made her desist from emptying it. Another woman who assisted Mrs. S. to do this work did not ail at all. She also helped to wash two blankets which had been on the sick bed. She was helped in these proceedings by two women, neither of whom have suffered from cholera or any other bowel complaint. This took place on September 7th, and, as already stated, Mrs. S. sickened next day.

I saw Mrs. S. on the evening of September 12th, and twice on September 13th. She was rapidly convalescing, and had taken some solid food on the morning of the 13th. The bowels did not act during my stay in Middleton, so no stools could be procured.

No. 17, Market Street, is a four-roomed house containing six people. It forms part of a collection of ten houses which have a common backyard. This yard is on the whole clean, though there are two coops of chickens in it. The town water is laid on. There are five privies, containing pails for the ten houses, and two dust-bins. Their contents are removed weekly. Waste pipes are cut off, and gullies are trapped.

There had been a fatal case of choleraic illness at Middleton, in July, and a second in August. The first case proved fatal on July 7th, after three days' illness, death being certified as due to "English cholera exhaustion." This case was that of a cotton spinner's wife, aged 28, a weakly woman, and very subject to diarrhœa. Her husband and four children were ailing at the time with diarrhœa, and there were six other cases (one adult, and five children), of diarrhœa in the same street, and two in an adjacent street at the same time. The medical men attending this woman spoke of her symptoms as on the whole mild; though there was considerable vomiting and purging, there were no marked cramps, no "rice water" stools, but little collapse and not much lividity. The temperature, however, was subnormal.

The second case terminated fatally on August 27th (*i.e.*, only eight days before Mrs. G.'s attack), after six days' illness, death being certified as due to "(*a*) choleraic diarrhœa; (*b*) cerebral congestion and exhaustion." This case was that of a woman 41, who was said to have been weakly and constitutionally liable to diarrhœa, from which she frequently suffered. She had violent vomiting and purging, marked cramps and abdominal pain. The motions were watery, at first light, afterwards dark, but never "rice-water." The symptoms abated, but she passed into a state of lethargic coma before death.

The husband of this woman had severe diarrhœa two days before his wife's illness, but recovered. None of their four children were attacked.

I could learn of no connexion with Hull, Grimsby, or other places in this case.

The symptoms of the attacks, fatal on September 5th and September 7th, especially of the first, were not distinguishable from those of true cholera.

Although no direct connexion could be traced between these Middleton cases and other infected places, *e.g.*, Hull and Grimsby, yet the existence of undoubted cholera at such places for several weeks antecedent to the first of them, coupled with the fact that at the end of August there had been an adult death from diarrhœal illness in Middleton, makes the history a very suspicious one.

Indeed, so far as I know, such an occurrence of fatal diarrhœal disease among adults, having such marked clinical symptoms as cramps, watery evacuations, and subnormal temperature, is in this country rarely to be found dissociated from true cholera infection.

App. A. No. 5.

On Cholera in Middleton; by Sweeting.

Immediately on my arrival in Middleton, I met the officers of the Authority, and convened a meeting of the Town Council, at which I advised as to the measures of precaution to be adopted. These were actively carried out. They included measures of cleansing and disinfection, the destruction of bedding and clothing, medical visitation of houses that had been affected and of neighbouring houses, as well as the addition of "diarrhœa" to the list of notifiable diseases.

No. 6.

Report upon a fatal Case of Cholera in Westminster; by Dr. R. Deane Sweeting.

App. A. No. 6.

On a fatal case of Cholera in Westminster; by Dr. Sweeting.

In accordance with instructions I made inquiry into the circumstances attending the death of Martha B. (aged 50), living in Marsham Street, Westminster.

The case was notified on September 7th, 1893, after it had proved fatal, to the Medical Officer of Health to the Vestry of St. Margaret and St. John, Westminster, by Dr. H. Scott, of 27, St. Ermin's Mansions, as "choleraic diarrhœa: cholera." The Acting Medical Officer of Health, Dr. J. Norton, thereupon gave information to the Local Government Board.

I found that the deceased, a widow, living with two daughters (aged 15 and 13), in one room, in Marsham Street, was employed as a "cleaner of the members' private rooms," at the House of Commons. She went to work there as usual on the morning of Tuesday, September 5th, at about 8 a.m., but returned home about 11 a.m., complaining of "violent pains in the inside" and in her back, vomiting, and profuse diarrhœa. Dr. Scott was called in at about 6 p.m. His assistant, Dr. Collier, first saw the case, and shortly afterwards Dr. Scott himself. He continued in attendance during Wednesday, September 6th, and saw the woman for the last time at 10 p.m. on that day. She died at 1.30 a.m., September 7th.

Mrs. W., of Barton Street, Westminster, sister-in-law of the deceased, who nursed the deceased during the greater part of her short illness, stated that, besides the sickness and frequent watery stools, there were cramps, hot and cold flushes, blueness of the hands and feet, and, latterly, great prostration and collapse.

Dr. Scott and Dr. Collier, who attended the deceased, stated that the patient had copious frequent "rice-water" stools, much retching and vomiting, cramps in the arms, but more so in the legs, blueness of the hands and feet (but more of the former), sunken eyes, livid complexion. The temperature was subnormal (95·2° to 95·4°) throughout; the pulse was feeble, "thready," and quick. The patient was intensely restless, throwing her arms wildly about, and she suffered from intense thirst. Her urine was diminished in amount, if not suppressed.

In company with Dr. Norton, and the Sanitary Inspector, I made a personal examination of the body on September 7th. The belly was tumid, and there were evidences of early post-mortem discolouration.

The house in Marsham Street is a ten-roomed house; two of the rooms were at the date of inspection empty, and the rest occupied by seven families, including that of the deceased. I could learn of no diarrhœal illness amongst the other six families. The rooms were occupied by a poor class of people and were not overclean. That of the deceased on the second-floor, however, was rather above the average of the others. There was some accumulation of refuse in the small backyard at the time of my visit. But this would be a nuisance common to the whole of the tenements, six of which were not invaded by diarrhœal illness.

I inquired minutely as to the deceased's habits and doings. She was a quiet retiring woman who seldom went out or received any visitors. She had received none such for some time, and had not been out of doors the week previous to her attack except to her work, save on

Saturday afternoon and evening. On the Saturday afternoon, September 2nd, she went out for an hour to seek for a new room in Smith Square, Westminster.* And in the evening she went out to a pork butchers, in Tothill Street, where she purchased some pickled pork and a rabbit for her Sunday's dinner.

(The deceased was accustomed to do half a day's washing every three weeks at a house in Smith Square. She last did so on August 21st. I made inquiry, and found that no illness, of diarrhœal or other sort, had taken place at this house.)

I ascertained that the pickled pork and rabbit bought on Saturday (September 2nd), was partaken of hot on Sunday (September 3rd), at 1.45 p.m. by the deceased and her two daughters. Besides that, they had no other food on that day with the exception of tea and bread and butter. On Monday (September 4th) all three of them had the same dish cold. That day, at about 3 p.m., both the daughters were attacked with pain in the stomach and diarrhœa. The mother, too, had slight diarrhœa at the same time, which, however, got so much better by the evening that she partook of some of the cold rabbit that was left. The daughters continued to have diarrhœa all Tuesday, whilst the mother was violently seized at 11 a.m., as before related.

Some of the stools passed by the deceased on Tuesday night, collected by Mrs. Walsh for Dr. Scott, were handed over by me to Dr. Klein for examination. Dr. Collier and I performed a necropsy of the deceased, and 12 inches of the lower part of the small intestine were also forwarded to Dr. Klein for examination.

[Examination of this material is reported to have shown the rice-water like character of the stool and of the bowel contents, together with a congested state of the ileum. Both contained comma bacilli; and the ileum contained numerous epithelial flakes crowded with bacilli which morphologically and culturally were typical of Koch's comma bacilli. For details, see page 177.]

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* Her daughter alleges that both she and her mother noticed a peculiar smell in this room. I visited it, but was unable to corroborate this statement. The room was apparently clean and in good condition.

No. 7.

App. A. No. 7.

On Disinfection of certain portions of the House of Commons after death of a female cleaner from cholera; by Dr. Copeman.

Memorandum as to Advice given with regard to Disinfection of Certain Portions of the House of Commons, in consequence of a Death from Cholera in the person of one of the Women Cleaners employed there; by Dr. S. Monckton Copeman.

In accordance with instructions I went over to the House of Commons on September 7th, 1893, at 4.30 p.m., in order to inspect certain portions of the premises and to advise as to what methods of disinfection might be necessary. I remained there in consultation with various officials till 8 p.m.

I first saw the Chief Inspector of Police on duty in the House, who referred me to Colonel Legge, the Deputy Sergeant-at-Arms. Failing, at first, to find him, however, I asked for the chief official of the Clerk of the Works' Department.

From Mr. Prim, who was acting temporarily for the Clerk of the Works, and from his assistant, I learnt that the woman in question was Martha B., that she was 50 years old, and further that she was employed in the department of the Sergeant-at-Arms, in sweeping and cleaning certain rooms in one particular section of the House, which, as I afterwards learnt from Colonel Legge's books, included :—

The Members' Private Secretaries' Writing Room.
The Conference Rooms.
The Public Bill Office.
The Votes and Proceedings' Offices.

All these rooms, together with a small washing closet and a small store-room opening to Westminster Hall, are self-contained in one particular block.

In reply to questions as to the water-supply of the House, Mr. Prim informed me that the greater portion of the water was obtained from the Government Works at Orange Street, at the back of the National Gallery, being raised from the Thanet sand and chalk beneath the London clay. At the entrance to New Palace Yard, however, an admixture takes place with a certain proportion of water from the Chelsea Company's main. This mixture is supplied throughout the House. He thought it unlikely that any water would have been drunk by cleaners while on duty.

I next saw Colonel Legge, who told me that the duties of the cleaners extended from 8 a.m. to 12 noon, with slight variations. He also stated that Mrs. B. had had charge of the same set of rooms during the whole of the present session, and it was not likely that she had been into any others. The dust, tea leaves, &c. that would be collected, she would take down to a small yard off the Star Court, which is approached by a narrow stairway from the rooms she had to tend. In this yard the contents of dust-pans, &c. are placed in three iron pails which are emptied every day, and cleaned every other day by being scraped and washed. At the base of this stairway, adjoining the entrance to Westminster Hall, is a w.c., and next door a sink and urinal. She would, he added, have thrown any washing water down this sink.

At my request H. B., an office-keeper having charge of this portion of the building, was called in, and Mrs. H. and Mrs. G., two cleaners who had known Mrs. B. fairly intimately, were sent for.

H. B. said that he frequently came across Mrs. B., and that she had always appeared a delicate woman. He had heard that she had been more or less troubled with diarrhœa for several weeks past, although he was not aware that she had made any complaint on Monday last. He added that Mrs. B. had told him that she had frequently used a closet adjoining the Members' lavatory. She had mentioned this to him

because a cloak-room assistant had "looked black" at her for using the closet.

Mrs. H. said that Mrs. B. had complained to her on Tuesday morning that a rabbit (Ostend) and pickled pork, which she had had for dinner on Sunday had disagreed with her, although at that time she looked quite well. Mrs. B. also told her that the drains had recently been up at her house, and that the filthy soil had been spread out in the yard. Mrs. B. had also mentioned that she had made use of the closet at the Members' entrance (at the bottom of the stairway already mentioned).

Mrs. G. said she did not work in the same rooms as Mrs. B., but she had walked home with her at noon on Tuesday, when Mrs. B. told her that she had been very ill, having suffered from severe diarrhœa all the morning. She had not seen her on the previous day.

On Tuesday evening Mrs. G. called to see her, when she found Mrs. B. in great pain, suffering from cramps and looking very ill. She had also been sick and exclaimed "its cholera, its cholera." Mrs. G. was so overcome that she left, and did not see Mrs. B. again alive. She could not say whether Mrs. B. had been sick in the House of Commons.

I then visited the rooms in which Mrs. B. had worked. They all communicate with one another on three sides of a court-yard. Just by Westminster Hall I found a small washing closet, from which the water had been cut off and which had been used by Mrs. B. for storage of pails and brooms. This place it seems possible she might have used in the event of being suddenly taken with sickness, especially as it is secluded.

On returning to Colonel Legge's room, I found there the Sergeant-at-Arms, and Colonel Carrington, while Sir Walter Foster came in shortly after.

I stated to them the results of the inspection that I had made, and what appeared to be desirable to be carried out in the way of disinfection.

My suggestions were as follows :—

1st. That all cleaners and other officers who might have come in contact with Mrs. B., either in the House, or at her own home, should be medically examined to ascertain whether they were suffering from diarrhœa.

2nd. That the closets adjoining the Members' lavatory and also the one by the Members' entrance, which all drain to one manhole in Star Court, and also the small washing closet adjoining Westminster Hall, should be thoroughly flushed out with a strong solution of perchloride of mercury.

3rd. That the carpets of the rooms in which Mrs. B. had worked should be taken up and disinfected by steam-heat, and that the floors should be scrubbed with a solution of perchloride of mercury.

I informed the First Commissioner of Works that the Sanitary Authority of the parish of St. Margaret and St. John, Westminster, would be willing to carry out the disinfection of the drains, but could not attend to the carpets, as they did not possess a steam disinfector.

To this course he agreed, and it was arranged that such disinfection should be carried out within a few hours. It was also arranged that the carpets should be taken up by workmen on the premises and sent to some firm undertaking the work of disinfection by steam-heat, and that the floors should be scrubbed, this to be done under the personal supervision of the acting Clerk of the Works.

The work was carried out in a satisfactory manner.

September 8th, 1893.

No. 8.

Report upon an Outbreak of Cholera in the Ashbourne Urban Sanitary District, Derbyshire; by Dr. R. Bruce Low.

This outbreak began on September 6th, 1893. During the seven days ending September 12th, 15 attacks of cholera occurred, all among persons residing in the yard behind the "Coach and Horses" public-house. Of the 15 cases, nine proved fatal. Three of the persons who had at the time of inspection already recovered had mild attacks. Of the three who were still under treatment, all of whom had severe attacks, two remained in a critical condition for some days, but ultimately recovered.

The first case was a delicate woman, the landlady of the "Coach and Horses" Inn. She had not recently been from home. She had slight diarrhœa on Monday and Tuesday, September 4th and 5th. She developed choleraic symptoms on Wednesday, September 6th, and died on the 7th. The course of the outbreak can be followed in the appended table:—

Wednesday, September 6th, one case which was fatal.
Thursday, Sep ember 7th, three cases, two of which were fatal.
Friday, September 8th, two cases, one of which was fatal.
Saturday, September 9th, five cases, three of which were fatal.
Sunday, September 10th, two cases, both of which were fatal.
Monday, September 11th, no cases.
Tuesday, September 12th, two cases, both recovered.

The symptoms in each case were similar, and Dr. Littleton, the medical officer of health, who had had some experience of cholera elsewhere, says he recognised the disease as identical with that which he had seen in 1866. The main characters were violent vomiting, profuse purging (the stools resembling rice-water), more or less suppression of urine, cramps, collapse, subnormal temperature, and in some fatal cases coma before death. A portion of the intestine from one of the fatal cases was sent by Dr. Littleton to Dr. Klein, who, after a bacteriological examination, pronounced the results as giving positive indications of Asiatic cholera.

Dr. Littleton from the first suspected that polluted water was the cause of the outbreak, and on Saturday night, September 9th, he gave instructions that the pump attached to the well in the "Coach and Horses" yard, should be put out of gear, so that water could not be got from it. To this precaution is probably due the cessation of the attacks, the last being on Tuesday the 12th. The Medical Officer of Health in consultation with Dr. Barwise, County Medical Officer of Health for Derbyshire, took further steps with a view to prevent extension of the disease. On Tuesday, September 12th, the well was emptied, and three hundredweight of quicklime was put into it. The yard drains were flushed with disinfectants; soiled linen was steeped in disinfecting solution; contaminated bedding was burnt, and other necessary precautions taken, apparently with good effect.

The public house along with another dwelling forms the north-east end of the yard which has a row of six houses on the west side of it, the other side being occupied by a wooden shed. There are altogether eight houses in the yard, with a total population of 39 persons.

Cholera appeared in six of the eight houses. The people were, for the most part, uncleanly in their habits, and dirty in their persons; lice in the head, and fleas on the body, being in evidence at my visit; indeed, for many years the yard has had the reputation of being one of the dirtiest and most disreputable in Ashbourne.

The six houses on the west side of the yard have only two rooms apiece, one upstairs and one down; they have no doors or windows at the back, and therefore no through-ventilation. Some of these houses are in bad repair. There is a double water-closet at the south-west end of the yard facing and about 10 feet from the door of the last house, (*see* Plate II.). Both of the closets are flushed by hand and were found to be in a filthy state. One basin has been roughly constructed with bricks and the joints of these retained the excrement, giving rise to a grave nuisance, so much so that the people in the lower house had been obliged to keep their door shut all the summer to keep out the stench arising from the closet.

The "Coach and Horses" Inn, is practically an unregistered common lodging-house, accommodating 12 or more "travellers." These consist of low-class hawkers, Irish harvesters, and other nomadic folk, who come no one knows whence, and go no one knows whither. People living close by give a bad account of the habits of these "lodgers." The charge for the night's lodging is from 4*d.* to 6*d.* There is a water-closet, also hand-flushed, inside the public-house, placed against the outer wall just beside the pump (*see* Plate I.). Close by is an urinal which, is often, it is said, extemporised as a privy on Saturday nights. In the yard is a slop gulley close to the pump with an old metal trap, the surface of the ground round this gulley is in no way protected to prevent soakage. Down this gulley, or rather over it, an eye witness stated, he has seen pails of human excrement emptied. The evacuations are passed sometimes in the houses into a pail which is emptied upon this gulley. In the centre of these sources of pollution is situated the well, which is 14 feet in depth. Water stands usually about 7 feet in the well, the sides of which are only dry-steined. The subsoil is gravel and sand, and therefore very porous.

The relation of the above sources of filth pollution to the well are shown in Plate I. All the persons in the houses attacked during this cholera outbreak used the water from this well for domestic purposes. The inmates of two houses only where this water was in use escaped attack. There can be no question that the well had been fouled from one or all of the three following sources, viz. :—

(1.) The soakage of filth from a broken soil pipe leading from the water-closet, in the "Coach and Horses" Inn, underneath which closet at the time of the outbreak the subsoil parallel to the well was found saturated with excrement to a depth of 4 feet or more, *and only* 18 *inches from this well.*

(2.) The urinal (*see* Plate I.) which was situate only 3 *feet from the well.* This urinal is a wooden erection provided for the customers of the "Coach and Horses." The bottom of the urinal is bricked, but the wooden wall next the well is saturated with urine which escapes into the subsoil close to the well.

(3.) A yard gulley *situated only* 1 *foot from the well,* and on which slops and excrement are frequently poured by the people living in the yard.

The pump attached to the well is placed directly above it. The well is covered by a few boards and about 2½ feet of loose soil. The well is not protected from the return of water spilled at the pump in the process of filling water vessels.

Samples of this well water were submitted to Dr. Klein for bacteriological examination. He found them to be teeming with true cholera bacilli.

It should be mentioned that occupiers of dwellings in the yard often receive for a single night or longer lodgers of the tramping class who are unable to be accommodated at the "Coach and Horses." This well must have received soakage through the closet of the bowel discharges of strangers, and in this way probably the specific poison of cholera was deposited in Ashbourne. Unfortunately all efforts to trace the individual or individuals who caused the mischief have failed.

The Ashbourne "wakes," the great holiday season for this locality, began on August 20th, and lasted to the 26th. At this time many strangers visit the town, and many visits at a distance are made by the inhabitants. Special trains took numbers of Ashbourne people to Blackpool, Liverpool, and Manchester. It is, however, more likely that the disease was brought by some ambulant case of the tramp class who may have come to the town during the wakes week; and who, while staying at the "Coach and Horses," specifically polluted the closet, and through it the well. As an instance of this in the case of another disease, I may mention that about a month before my visit a man was removed from the "Coach and Horses" to the workhouse suffering from a typical attack of enteric fever.

Every summer and autumn there is a recurrence of "summer diarrhœa" in Ashbourne. This year (1893) it was stated that the number of cases had been greater than usual. None of the cases, however, are said to have shown any of the virulent choleraic symptoms which characterised the outbreak in the "Coach and Horses" yard. Two of them occurred close by this yard; one case, a child, aged two years, was attacked on September 8th, but recovered after five days' illness. There was a possibility that this child had played in the "Coach and Horses" yard, and might have received specific infection there. The drinking water ordinarily used by this child was obtained from another well than that already described, and situate 25 yards from it. The other case, a woman aged 71, began on September 9th. She was a charwoman living in a yard adjoining the "Coach and Horses" yard. She had no vomiting or other symptoms beyond diarrhœa. She recovered in four days. Her drinking water was obtained from a well situate close to the house, the same as that from which the child referred to would usually get its supply.

The population of the Urban Sanitary District of Ashbourne was 3,810 at the last census. The water-supply is from wells, all more or less liable to pollution. A scheme for a new water-supply piped from a spring two miles from the town was adopted by the Urban Authority at a meeting held on September 15th, and a loan of 7,000*l.* is to be applied for at once to defray the cost.*

Considerable opposition has been offered by a section of the public in the town to the proposed new scheme which had at the date of my visit been before the Authority for some 12 months. When a poll of the ratepayers was taken it showed a majority of only 50 votes in favour of the new supply.

The condition of Ashbourne is such as to favour the spread of cholera or any other filth disease, and it is a matter of great urgency that a new public water-service should be completed with as little delay as possible. The Urban Sanitary Authority at the time of my visit seemed anxious to push on this greatly needed improvement, but they have in past years been altogether apathetic in respect of sanitary improvements in the town.

* This scheme fell through owing to legal difficulties.

Description of Plate A.

1. The well in the "Coach and Horses" yard (it had been uncovered at the time the photograph was taken).

2. The pump immediately over the well. (At the time the photograph was taken a temporary pipe had been attached to convey the water pumped from the well to the gulley in the process of emptying it.)

3. The gulley close to the well: down this excrement had been commonly emptied by the inhabitants of the yard.

4. Window of the "Coach and Horses" watercloset close to the well, alongside of which filth from the broken soil-pipe had been accumulating for some time.

5. The urinal used by the customers of the "Coach and Horses."

6. Back entrance to the "Coach and Horses."

PLATE A.

PLATE B.

PLATE B.

1. The double water-closet at the end of the "Coach and Horses" yard, for use of the six houses, and situated 10 feet from the door of the last house, which door had to be kept shut all the summer owing to the foul smells emanating from the defective closet.

No. 9.

App. A. No. 9.

On Cholera Occurrences in Malton R.S.D. in 1893; By Dr. Copeman.

Report on the Circumstances attending the Occurrence of certain Cases of Cholera in the Appleton-le-Street Division of the Malton Rural Sanitary District; by Dr. S. Monckton Copeman.

In consequence of the receipt of a letter from Dr. Colby, the Medical Officer of Health for the Malton Rural Sanitary District, in which he stated that he had received two notifications of "Choleraic Diarrhœa? Cholera" from Appleton-le-Street, I received instructions to visit Malton, to investigate the circumstances of the cases, and to advise the officials of the Authority as might be necessary.

I arrived at Malton on the evening of September 21st, and was met by Dr. Colby, with whom I had made an appointment by telegram. He gave me a brief outline of the information which he had up to that time been able to gather, with reference to the cases which had been notified to him, and we arranged to visit Appleton on the following day; he also gave notice to the Inspector of Nuisances to meet us there.

Upon arrival at the village, I learnt that one house only had been invaded. This was a somewhat small, but fairly substantial, detached stone building, situate close to and on a level with the main road. Behind the house the ground slopes down from the road at a somewhat considerable incline, to pasture land which forms part of a small freehold farm property to which the house also belongs.

At the time of our visit, the only person in the house was an old woman, from whom, on account of her condition of chronic alcoholism, but little reliable information was to be extracted. While there, however, the medical attendant, Dr. Steer, and Alfred B. an intimate friend of the former occupier, joined us and mainly from them and from Dr. Colby, I gathered the following particulars as to the cases which had occurred. These I now set down in chronological order.

Case 1.—John E. (the owner of the small freehold above mentioned), aged 28, died on September 10th, 1893. For years he had been a free drinker and had suffered chronically from diarrhœa which was believed to be dependent on cirrhosis of the liver. He had been accustomed every now and again to leave home on a drinking bout; and with this object he went to Scarborough on August 31st and stayed at Hampton Road at the house of Mrs. W., half sister of his wife. Here he was joined on September 5th by his friend B., who remained, however, for one night only. B. stated that at this time John E. was obviously the worse for drink, but otherwise appeared to be in his usual health. He further stated that John E. had spent most of his time either at the cricket-field (it was the Scarborough cricket week) or inboating on the sea. He had apparently eaten little, but had been drinking heavily. As far as was known he had no fish or indeed any food, beyond the little he took at the house where he was staying, with the exception of some oysters, of which on at least one occasion he had partaken copiously at a stall on the sands. He left Scarborough late at night on Wednesday, September 6th, and complained of feeling ill before his arrival at Appleton. Next day, after arrival at Appleton, he suffered from severe diarrhœa, and he is believed to have paid several visits to a privy which is built against the side of his house at Appleton. On Friday, September 8th, he was so ill that his friends sent for Dr. Steer, who on his arrival found John E. conscious indeed, but collapsed and pulseless, with sunken eyes and blue lips, his limbs "icy cold" to the touch, and complaining of severe cramps. He had apparently no control over the bowels, and was passing more or less continuously watery stools of a milky appearance and bad smell. He died in the early hours of Sunday, September 10th.

This case was not specially reported at the time, as his symptoms were looked upon merely as an exaggeration of his normal condition, and it was only on the subsequent occurrence of other cases in the same house that the probability of the disease in John E.'s case having been true cholera suggested itself.

Case 2.—Mrs. R., a sister of Mrs. E. (wife of John E.), came from Terrington to Appleton on September 10th, on learning of the death of her brother-in-law. She remained apparently in perfect health until the morning of the day on which the funeral of John E. took place (September 12th), when she was attacked with diarrhœa, but having no sickness and but little pain, she did not at once take to her bed. Her symptoms appeared, for a time, to be ameliorated by a pill of lead and opium, together with some chalk mixture. She was naturally rendered somewhat prostrate by grief, and cramps in the limbs coming on she went to bed, almost immediately after the funeral. At the time of my visit (on September 22nd) her motions were loose, but appeared fairly normal. Though she then seemed to be still in a somewhat critical condition, she ultimately recovered.

Case 3.—This was the case of George B., aged 70, father to Mrs. E., He lived at Terrington, a village about five miles distant from Appleton, but went on September 12th to John E.'s funeral, after which he returned to his own house. At this time he was in good health. On Monday, September 18th, he went to Appleton again to stay with his daughter for a few days. On the following day he walked to Malton to attend the market, leaving Appleton about 9 a.m. He did not have any dinner at Malton, but was heard to ask in a public-house for three pennyworth of gin; a most unusual circumstance, as he was practically a teetotaller. Whether or not he felt ill at this time is not known, but on the way back to Appleton he was attacked with abdominal pain, cramps and severe diarrhœa, so that from Swinton, a place less than two miles distant from Appleton, it took him an hour and a half to reach home. No sooner had he arrived there than he was seized with an attack of vomiting. At 5.30. p.m. (September 19th) he was seen by Dr. Steer. At that time he was collapsed and pulseless; the skin cold and the toes bent up by cramp. A thin watery fluid containing whitish flocculi was running, almost continuously, from the bowels. On trying to rise in bed, because of an attack of vomiting, he fainted. Hot water bottles were placed in the bed and friction applied to the limbs; the latter treatment appearing to relieve the cramps somewhat. Dr. Steer paid another visit at 1.15. a.m, on Wednesday morning (September 20th), when he gave a hypodermic injection of ether. George B. died, however, about an hour later. It was noticed after death that the skin, particularly of the limbs, was much puckered and wrinkled.

Case 4.—Blanche E. aged 27, the wife of the first patient, and daughter of the third, died on September 20th, about 12 hours after her father. She appeared to be quite well when Dr. Steer visited George B. on the previous day, but, about half an hour after he had left, she was attacked with diarrhœa, vomiting, and cramp. She took a dose of chalk mixture and a neighbour applied friction to the legs. At 1.15. a.m. (September 20th) Dr. Steer saw her, when he considered that though she had an anxious look and was suffering from cramp in the limbs, she was by no means *in extremis*. An hour later, however, she became much worse, and she passed typical "rice-water" stools almost incessantly. She retained consciousness throughout and Dr. Steer, who remained with her to the end, told me that he thought that some slight improvement had set in, when she died somewhat suddenly. A portion of the ileum from this case was sent to Dr. Klein, who stated that the results obtained, microscopically and bacteriologically were typical of cholera.

Mrs. E. had, I found, slept on Monday night (September 18th) in the same bed in which her husband died; in order to give up her own bed to her father. The bed-clothes in which she slept had been saturated with the discharges of the first patient, and although they had been hung up to dry in the open air, they had never been washed or disinfected in any way. A girl, of whom further mention will be made later on, also slept with her. Mrs. E. had attended her husband during his illness.

I made careful inquiries as to the food and drink which had been partaken of by the last three cases, but could discover no circumstance of a suspicious nature in this direction, as it appeared that no one of them had had anything which had not been also, in part, consumed with impunity by other persons. Some complaint was made, locally, as to the water supply, which was obtained from a surface well situate at the bottom of the hill, behind the house, and which was very imperfectly protected from surface pollutions. Accordingly, at my request, samples were taken, one of which was analysed chemically, while the other was sent to Dr. Klein for bacteriological examination. The water proved to be of bad quality, owing to organic impurity, but no proof could be obtained that it had become specifically infected with the cholera organism.

Case 5. A child aged 16, a daughter of Mrs. W. of Scarborough, and niece of Mrs. E. This child, who had slept in the same bed with her aunt on September 18th, had been staying at Appleton, but was taken back to Scarborough (where I saw her) by her father on September 21st, the day following that on which George B. and Mrs. E. had died. Unfortunately, the child is deaf and dumb, so that it was impossible to extract much information from her, but through her mother, I learnt that she had, as might have been expected, used the same privy as the other persons at the Appleton house. At the date of my visit to Scarborough I found the child was suffering from a fairly sharp attack of diarrhœa and had complained of some pains in the body. The Medical Officer of Health (Dr. Monk) promised to visit the patient every day, and if it should appear desirable, to send some of the stools to Dr. Klein for examination. I have since heard from him that the child has recovered entirely, and no similar symptoms have appeared in any other of the inmates of the house.

On inquiry of Mrs. W., at Scarborough, I learnt that six persons had been staying in the house at the time of John E.'s visit. None of these persons, except John E. himself, had partaken of any oysters. All other articles of food they had had in common. With the solitary exception of the child above mentioned, not one of these persons had any diarrhœal symptoms.

I also took the opportunity, while at Appleton, of going to Terrington, the village in which George B. had lived. At his house, which was of a somewhat superior type, I found his widow, an old woman 70 years of age, and also a girl of about 16 years old named K., who had, she said, stayed at Scarborough during the time that John E. had been there. These two persons appeared to be in perfect health, and I learnt that George B. had not suffered from any illness for some considerable period, prior to his visit to Appleton. I also saw the local medical practitioner, who stated that the district had been singularly free from diarrhœa of late.

The cases of cholera and choleraic diarrhœa were therefore entirely confined to those who had been inmates of John E.'s house at Appleton; all the inmates, whether permanent or temporary, being affected to a greater or less degree. And there are grounds for believing that the later cases owed their infection, either directly or indirectly, to John E., who, in all probability, himself contracted cholera while at Scarborough.

Owing to the fact that, by a process of exclusion, it appeared possible that John E. had contracted the disease as the result of eating a quantity of oysters, while in a broken-down state of health, I made some inquiry at Scarborough, with the assistance of Dr. Monk, the Medical Officer of Health, as to the source of the oysters and other shell-fish that were sold in the town.

For this purpose, we first visited the stalls on the beach where John E. had obtained the oysters he had eaten. Here we found that no shell-fish, other than oysters, were sold, and these, we were informed by the stall-holders, came almost entirely from two wholesale dealers at Cleethorpes. In addition, we visited all the shell-fish shops in the town, but, at several of these, we were unable to obtain any reliable information, as a rumour had apparently got abroad as to the object of our visit. In two instances, however, we found that both oysters and cockles were obtained from Cleethorpes.

At the time of my visit to Appleton, I ascertained that, by direction of the Medical Officer of Health, all suspected bedding, including sheets, mattresses, feather-beds, and rugs had already been burnt, as had also the carpets and curtains of the bed-rooms. In these rooms also the paper had been stripped from the walls, and the floors had been scrubbed.

I found, however, that an outside box-privy which had been built against the house at a point adjacent to the larder, and which had apparently been used by all the inmates of the house in the earlier periods of their illness, had not been cleansed or disinfected. The box was almost full of semifluid material, which exhaled an extremely unpleasant odour. I suggested, therefore, that the box should immediately be filled up with carbolised sawdust, to prevent any fear of the contents being spilt, that it should then be removed to a distance, be saturated with paraffin oil and burnt. I have since learnt that this procedure was carried out by the Medical Officer of Health himself, the Inspector of Nuisances having refused to undertake the work. I also strongly advised that the privy should be removed altogether, and rebuilt a short distance from the house, and I have reason to believe that this will be done.

I append an extract from the death returns, obtained from the local Registrars of the Malton Rural Sanitary District, showing the number of deaths from diarrhœa which had occurred in the district between August 1st and September 23rd, 1893.

Malton Rural Sanitary District.

Registration of Deaths from Diarrhœa.

August 1st to September 23rd, 1893

Sex.	Age.	Cause of Death.
F.	73 years - -	Diarrhœa. 8 days.
F.	6 months - -	,, 3 days.
M.	2 months - -	,,
M. (John E.)	28 years - -	Chronic Alcoholism. *
F.	12 weeks - -	Diarrhœa.
F.	4 months - -	,, and Bronchitis.
F.	4 months - -	Acute Diarrhœa.

* Diarrhœa not mentioned in Death Certificate.

None of these cases, with the exception of John E.'s, occurred at Appleton.

No. 10.

Report on a Case of Cholera at Morton and on Cases of Choleraic Diarrhœa at Owston Ferry, in the Gainsborough Rural District; by Dr. R. Bruce Low.

On September 7th, about 3 o'clock in the afternoon, J. R., aged 56, and residing at Morton, was taken ill with diarrhœa while at work in the fields. The parish of Morton had in 1891 a population of 1,137. He was brought home in a cart, and rapidly developed symptoms identical with those of cholera, from which he died about 10 o'clock the following morning, September 8th, his illness having lasted only about 19 hours. Bacteriological examination of a portion of the bowel resulted in Dr. Klein declaring that the "cultivation "experiments showed the case to have been decidedly Asiatic cholera." The case at the beginning was seen first by Dr. Passmore of Gainsborough, and later on by Dr. Wright, the Medical Officer of Health. Both of these gentlemen regarded the case from the first as one of true cholera.

The household comprised, in addition to J. R., his wife and three grown-up sons. One of the sons paid a visit to Hull to some relatives, on Monday, August 28th, and returned to Morton on August 31st. This young man states positively that neither during his stay at Hull, nor afterwards had he noticed any relaxation of his bowels. He further stated that he had brought home with him on August 31st a halibut, which he had bought, at the dockside in Hull, the same morning. It was in a perfectly fresh state, and part of it was cooked and eaten by the family the same evening. The next morning, Mrs. R., aged 50, wife of J. R., was attacked with diarrhœa which lasted till September 5th. While at the worst she had, according to her statement, about 10 motions a day. She had no vomiting, but there was some "twitching" or griping in the body. She was at the time of her attack in delicate health, having just recovered from influenza. No other case of diarrhœa followed in this house till the fatal attack of J. R., on the 7th September; but on Saturday, the 10th September, one of the other sons suffered from looseness of the bowels; this lasted only about 24 hours. He had no vomiting or cramps, and could take his food as usual. There was, he states, "a dull pain in his body," and he "felt rather faint at times."

J. R., who died, had been previously a healthy man. He, at long intervals, occasionally took too much beer. He had not been recently from home, with the exception that on Monday, September 4th, he was at West Stockwith Fair (about 3 miles distant). He had nothing at Stockwith except some bottled beer. Two of his sons went to Doncaster (St. Leger) Races, on Wednesday, September 6th.

J. R., along with his three sons, farmed some 20 acres of land near Morton. This land was manured with stable litter and contents of privy middens got in Morton, and led in their own cart to the fields. One day during the same week that J. R. was attacked (the precise day could not be stated) he and his sons had emptied several midden privies, and taken the contents to their land. On the morning of September 7th, the day of his illness, the privy midden in his own yard was emptied by two of the sons, the father assisting. He "cleaned up" the yard after the emptying was completed. About two cart loads of excrement and ashes were taken out of this privy midden, and among this would be the diarrhœal dejections of Mrs. R. (who suffered from September 1st to 5th) and the bowel discharges of the son since his return from

Hull. The son who was seized with diarrhœa on September 10th was one of those who took part in this work.

These people were of cleanly habits, and their house, I am informed, was well-cared for. They suffered in no way from privation. The house is a double cottage, the other half being occupied by a family of eight persons, none of whom have suffered in any way recently from diarrhœa or similar illness. A narrow yard is behind the houses, common to both. This yard is of varying width, part of it being 12 feet, and part of it only 6 feet wide. Midway between the houses and close to the walls stands a pump well, said to be 20 feet deep, and used up to the death of J. R. by both families. The yard is paved in part with rough cobbles which permit water to stand on the surface. Through the yard runs a channel for slops, but this is unevenly laid, and permits pools to form.

The privy, which is connected with a deep but covered ashpit, is situate at one end of the yard. The privy door is 6 feet from, and almost facing, the back door of J. R.'s house. The privy discharges into a covered midden pit which is about 5 feet by 4 feet, and excavated 3 feet below the level of the ground.

* * *

While making inquiry at Morton into the circumstances attending the death from cholera there, I extended my inquiry to Owston Ferry, where, prior to my visit, Dr. Steen, the resident practitioner, had informed the Medical Officer of Health, Dr. Wright, that six fatal cases of choleraic diarrhœa had occurred in that village between July 31st and September 14th, 1893. I learned that, during the same period, a number of cases of diarrhœa, estimated at "50 or more," had occurred, and that the symptoms differed in severity in different cases. It appears that "summer diarrhœa" is comparatively rare in Owston. Dr. Steen stated that during the four or five years he had practised in the locality he has seen very little, if any, of it. There were no deaths from "infantile diarrhœa" during 1892 and 1893. The parish of Owston Ferry had in 1891 a population of 1,276. There have, however, been at least three cases of choleraic diarrhœa at Susworth (population, 150), on the opposite side of the Trent, three miles lower down the river, during the last few weeks. Dr. Steen saw one case there, and Dr. T. B. F. Eminson saw the other two. One of the latter cases was taken ill suddenly in the fields, and was brought home in a cart in a cold and collapsed condition; he recovered. A child of this patient died at Susworth early in the present year from acute gastric catarrh, having been seen only once, and then in a moribund state, by Dr. Eminson. The child's illness was mainly, at first, vomiting and purging. He died unconscious.

The dates of the fatal attacks at Owston and other particulars are given in the subjoined table:—

No.	Date of Death.	Initials of Case.	Age	Residence.	Duration of Illness.	Water Supply.	Excrement Disposal.	Symptoms.
1	July 31 -	Mr. J. D. -	49	Main St., Owston.	2 days -	Rain water and well water boiled.	Vault privy	Vomiting, purging, stools in no way resembling rice-water; thirst, cramps in feet. Died in a state of collapse.
2	Aug. 4 -	Mrs. E. W. -	80	"	10 " -	Rain water boiled.	"	Vomiting, purging, pain in body; chills.

No.	Date of Death	Initials of Case.	Age	Residence.	Duration of Illness.	Water Supply.	Excrement Disposal.	Symptoms.
3	Aug. 14	Mr. J. B. -	82	Main St., Owston.	5 days -	Trent water filtered.	Midden privy.	Vomiting, purging, chills. His son and grandson had diarrhœa and sickness about the same time, as also the next door neighbour.
4	„ 21 -	Mrs. A. W. -	85	„	10 „ -	Rain water boiled.	Vault privy	Vomiting and purging. Died unconscious.
5	Sept 11 -	R. C. (boy) -	7	„	5 „ -	Trent water boiled.	„	Vomiting, purging. No cramp. Died comatose.
6	„ 14 -	Mrs. J. T. -	58	„	20 hours*	Rain water boiled.	„	Vomiting, purging, cramps in body and thighs. Temp. 99. Pulse feeble; eyes sunken, slight cyanosis of face. Voice husky. Collapse.

* This patient had been suffering from diarrhœa for some days before, but the symptoms abated for about 24 hours before the acute illness appeared, which lasted only about 20 hours.

The fatal cases were scattered along both sides of a long main street a quarter of a mile or more in length. There appeared to be no circumstances common to any group of them. The Medical Officer of Health was of opinion that the emanations from the sewer, which runs along this main street, were the cause of the illness. The sewer is of antiquated construction, square in shape, constructed of brick on three sides, the top being composed of flagging. There is no ventilation provided, and the gradient is almost nil. Its outfall is into a ditch which ultimately reaches the river. Although there is an arrangement by which at high tides a sluice can be opened and river water admitted to flush the sewer, yet there are, I am told, objections to this, arising from the fact that the muddy water silts up the flat bottom of the sewer and gives rise to obstruction by accumulations of solid matters along with the silt. There are some openings admitting surface-water from the gutters to the sewer, but during the recent hot weather, these openings were either untrapped or imperfectly so, and bad smells from them have been common. There is need of a new sewerage scheme for this large village.

Upon inquiry, I found that there were frequent and intimate intercommunications between Owston and the town of Hull by persons going regularly with produce to Hull market, and by persons going to reside with friends at that town, or Hull people coming on visits to relatives in Owston. As illustrating how easily choleraic disease may be brought, I may mention an instance where in a house at Owston there had been staying a visitor from Hull who came to the village suffering from diarrhœa, which lasted for some days during her visit. This visitor did not arrive in Owston, however, till August 17th, previous to which date three of the deaths from choleraic diarrhœa had already taken place. From the condition of the drainage of Owston, its water

supplies, and its methods of excrement and refuse disposal, it is evident that choleraic disease had facilities for spreading in the village; and that there existed ample opportunities for the importation of the disease from already infected localities such as Hull.

September 28, 1893.

App. A. No. 11.

On Cholera Occurrences in Great Yarmouth in 1893; by Dr. Copeman.

No. 11.

Report on the Circumstances attending the Occurrence of Cases of Cholera and Suspected Cholera at Great Yarmouth; by Dr. S. Monckton Copeman.

In accordance with instructions I paid a visit to Yarmouth (population 49,334 in 1891) on September 28th, 1893.

On my arrival I attended a meeting of the Sanitary Committee of the Town Council, which I had previously summoned by telegram. Before the meeting, however, I was able to obtain certain important details, as to the existing state of affairs, from the Medical Officer of Health, who met me at the railway station.

At the meeting I called attention to the fact that, in addition to two or three highly suspicious cases, one of undoubted Asiatic cholera had occurred in the borough, and that it therefore was the duty of the authority at once to take all possible precautions for preventing, if possible, further spread of the disease.

In reply to questions I elicited the following statement as to what had already been done:—

1. A printed notice had been distributed to wherrymen which gives information as to where they can obtain fresh water for drinking and cooking purposes, free of charge. All wherries arriving at Yarmouth, of late, have been inspected, as to the presence of nuisances or of possible cases of infectious disease.
2. A printed notice had also been issued to mussel-dredgers warning them not to use river-water for cleaning shell fish.
3. A sub-committee of the Sanitary Authority, termed the Health Committee, was formed on September 8th, 1893, "with power to "carry out any measures that might be necessary to prevent the "importation into or the spread of cholera in the town." This sub-committee had had several meetings since that date.

After promising to meet the Health sub-committee on the following day, I went, in company with the Medical Officer of Health, the Inspector of Nuisances, and Dr. Ryley, the medical attendant, to see a child who had been taken ill with symptoms indicative of cholera an hour or two previous to my arrival in the town.

The child's parents live at No. 31, in "Row" 34, but the father is at present absent at sea. Four children live at home, their ages ranging from 16 months to 9 years, the eldest being the girl, Sarah Ann P., who had been taken ill. The house consists of three small rooms, one above another, each of which has a single window opening towards the Row; no means of through ventilation therefore being afforded. Arrived here, we found the patient lying in a state of collapse, on a sofa in the lowermost room, in which the mother and three other children were having tea.

With regard to the child's illness, I obtained the following particulars: She had been, to all appearance, in perfect health on going to bed the previous night (September 27th), but at 3 a.m., on the morning of September 28th, she woke her mother, with whom she was sleeping, stating that she had severe stomach-ache. Immediately after, the bowels were moved, the motion, according to the mother's account, being like water, and having very little colour. At 7.30 a.m. the child got up, but took no breakfast except a little tea, which she immediately vomited up. While in bed she had also made complaint of pains in the legs, and this symptom reappeared in the afternoon. About noon she

again vomited, the vomit being "like water," and at 1 p m. she was seen by a medical man who gave some castor oil, which was speedily ejected by the stomach. The child at this time was very cold, and when the temperature was first taken at 4 p.m. it was found to be 95·2° F. A small quantity of bismuth and ammonia mixture had been given and retained.

At the time of my visit, the child was conscious, but apparently sleepy, not complaining of pain, but with beads of perspiration on the forehead. The skin was cold, the thermometer indeed refusing to register the temperature, which was necessarily therefore below 95°F. The eyes were sunken and the lips and hands were blue. The heart was beating at 134 per minute, but no pulsation was perceptible at the wrist.

The Medical Officer of Health told the mother that the child ought to be removed to the hospital, but this she refused to allow, being supported strongly in her opposition by several friends who had come in while we were there. Persuasion proving of no avail, a magistrate's order was after some delay obtained, and eventually, about midnight, the child was removed to the Isolation Hospital at Gorleston. On seeing the place, some relatives who had accompanied the child, stated that they had changed their opinions, and were quite content to leave her there.

Putting together briefly certain items of information that I collected at various places, I learnt that the girl, Sarah Ann P., went to school at the British School in the Market Place. She was said to be a quiet shy girl, who appeared to make no friends, as she always came to school and left it alone. One of the mistresses told me that the child had always seemed weakly, but had not appeared to be worse of late. She was always regular and punctual in her attendance, and had not been absent from school for a single day since the summer holidays until she was taken ill.

I further learnt that the child had, on the days previous to her illness, partaken of precisely similar food to the rest of the family, and with the exception of a little mackerel three days before, and an apple or two a week previously, had not had, as far as the mother was aware, anything in the nature of fish, shell-fish, uncooked fruit, or vegetables. Also, she had apparently remained in the house except when at school, it not being her habit like that of many of the children in the neighbourhood to play about in the "Rows."

Within a few doors of the house, but in the main road, is a shell-fish shop. The woman who keeps it informed me that she had supplied children living in the adjoining Row, from time to time, but she did not know their names. Her cockles are obtained from King's Lynn,* and the mussels locally. I was unable to obtain any evidence that the child, Sarah Ann P., had partaken of any shell fish lately.

The child still remained at hospital, and when I last saw her, there appeared to be considerable improvement in her condition, notwithstanding the fact that Dr. Klein certified that a specimen of rice-water stool passed on the first day of her illness, and which I had sent to him for bacteriological examination, was practically a pure culture of the true cholera bacillus. Dr. Klein's report on this case will be found in Appendix B., page 183. [I afterwards learnt that the child died, after a stay of about a week in hospital.]

On my first visit to the house, I found that a quantity of the watery bowel discharges had been thrown by the mother into an open channel,

* As to the origin of King's Lynn cockles, *see* Case III., page 143.

which runs the whole length of the "Row." This fact, having also come to the knowledge of the Medical Officer of Health, he had already had the channel copiously flushed with a strong solution of carbolic acid.

The following day (Friday), the whole house was fumigated with sulphur, and all hangings, &c., disinfected by high pressure steam; the linen actually used by the patient being burnt.

After making a round of visits in company with the Medical Officer of Health, in reference to other of the cases which had occurred in the town, I attended a meeting of the health sub-committee, to whom I gave some account of what I had done since my arrival in the town, and with whom I left a paper of recommendations as to precautionary measures, which I advised should at once be put in force in the district.

As the result of my inquiries, I had found that three other suspicious cases, of which two had terminated fatally, had previously occurred in the district.

Case I. An itinerant water-cress seller of age unknown (said to be about 56) an inmate of a common lodging-house, was reported to the Medical Officer of Health on September 8th as suffering from an attack of English cholera. It appears that he made his supper, on the previous evening, of some stale fish, which when fried gave out so unsavoury a smell that the keeper of the lodging-house advised him to throw it away. He was removed to hospital where he speedily recovered. The house was disinfected and the patient's clothes burnt. The symptoms, as related to me, did not appear to afford evidence that the case was one of true cholera, although he suffered from diarrhœa and cramps. He had left the town prior to my visit, and I could learn nothing as to his movements before or after his illness.

Case II. Mary Ann H., aged 53, a widow, living at No. 17 in "Row" 101. She had, I was informed, suffered at intervals for some years past with "spasms of the stomach" which were usually accompanied by some diarrhœa and sickness and occasionally by cramps. She had, however, been free from attacks since Christmas, when she was attended by Dr. Ryley. She had formerly also attended at the Yarmouth Hospital. On Monday, September 18th, Dr. Ryley was called to see her, she having been attacked with diarrhœa in the morning. Later in the day she vomited, and this occurred again in the night, when she also complained of cramp, especially in the legs. From 9 p.m. on Tuesday to 4 a.m. on Wednesday the 20th, she is stated to have slept peacefully. She then awoke her daughter, who slept with her, and before medical aid could again be obtained she expired. The motions are stated to have been very watery, but of a fairly deep yellow colour. Further I learnt that the eyes were not sunken, that there had been no blueness of hands or lips, and that the patient had made no complaint of being cold. For some days prior to her death she had taken but little food, but that little had been identical in quality with what was eaten by the rest of the family, who, to the number of four (3 sons and 1 daughter) had not suffered from any similar attack.

The patient was buried on Friday, September 22nd, and precautions taken with regard to disinfection as if the case had been one of true cholera. Whether in fact it was a case of this disease or not there is little positive evidence to show.

Case III. Alfred John M., aged 13 years, had been living with his parents at 26, St. Peter's Road, a part of the town remote from the "Row" District, and attended St. James' School.

This boy is stated to have suffered for a year or more from pleurodynia, which, according to his account, was always relieved by bathing. Whether for this reason or not, he is stated to have been in the habit of bathing

either in sea or river pretty nearly every day, and often more than once in the same day. He had last done so on September 16th, from which day onwards he is said to have suffered from slight diarrhœa.

With the exception of this looseness of the bowels and pain in the side, he had been quite well up to Wednesday, September 20th, when he complained of slight stomach-ache. This, however, had disappeared in the evening. He acted as errand boy to a Miss B., to whom he went before and after morning school, and on leaving home for her house on Thursday morning the 21st, he made no complaint of feeling ill, although he ate no breakfast, and afterwards refused to go to school. This latter fact, however, loses its apparent importance, as I found on reference to the school books that he had played truant on many occasions of late.

Later in the day he was seized with sickness, purging and abdominal pains. At 6.45 p m. he was seen by Dr. Wrigley, who found him in a state of collapse, with sunken features, face and extremities cold, and of dusky hue, feeble pulse, and temperature of 95·2° F. Urgent vomiting and diarrhœa had set in, and a chamber utensil was found half full of a colourless watery fluid containing a whitish flocculent deposit. There was complete suppression of urine. The lad lay in an apathetic condition, but was conscious and answered questions. Dr. Wrigley ordered brandy at frequent intervals, with ice to suck. He was wrapped in blankets, and hot water bottles were placed in the bed. There was no complaint of cramp.

The case was seen by the Medical Officer of Health in company with Dr. Wrigley on the morning of Friday, September 22nd. There was now more profound collapse. Vomiting has occurred ten times in the night, but diarrhœa had ceased since the previous evening. The lad died about 2.30 p.m. on September 22nd. A portion of the ileum was subsequently sent to Dr. Klein for bacteriological examination, and he reported having obtained results typical of cholera. See Appendix B., page 182.

This boy's parents let out their rooms to lodgers in the summer months, and two had left on the morning on which the boy was taken ill. As far as is known these people had not suffered in any similar way. The sanitary condition of the house is good, and the water is supplied from the Company's mains. The boy had the same food as his parents and three other children, all of whom remained quite well. He is said to have been seen to pick up and eat a raw mussel from a stall, and it should be stated that almost next door to his home is a shell-fish shop, where fried fish and potatoes are also sold. As the boy's father is a fish-seller it is hardly likely that the boy would have gone out to obtain fish, but the owner of the fish shop in question admits that this boy had been in on several occasions for "chip" potatoes, but he did not know, he said, whether the boy had ever had any shell fish there. The stock of cockles is said by the owner to be obtained from Lynn, but I have received information that Cleethorpes cockles are now sold through Lynn, so as to hide the fact of their origin. The mussels, the shopman stated, were obtained locally.

As will be seen by the appended maps* of Yarmouth, a sewer draining the Royal Naval Hospital and some rows of houses between the Hospital and the river, opens just above the shelving beach of Beeching's yard, where A. J. M. was accustomed to bathe when taking a dip in the river. This sewer is very foul, and great complaints are made locally as to the stench from it. To prevent the nuisance in part, the end of the sewer

* Not reproduced.

has been taken beneath low-water mark. When I visited the spot I found a large box of eels, suspended in the water just over the sewer mouth, for fattening purposes. A. J. M. had said that he had frequently swallowed some of the water he was bathing in, and if this was the case, it would appear that he might possibly have received infection in this manner, supposing that the discharges of previous cases of the disease had been emptied into the sewer. Of this, however, although I made diligent inquiry at the Naval Hospital and elsewhere, I could obtain no evidence.

In accordance with my suggestions, the chief constable was directed to prevent bathing in the river below the bridge, and the Medical Officer of Health was directed to take steps to prevent the storage of eels in the same part of the river.

I have only to add that the whole house in St. Peter's Road was carefully disinfected under the superintendence of the Medical Officer of Health, and all soiled linen destroyed.

No. 12.

Report upon an Outbreak of Cholera in the Ilkeston Urban Sanitary District; by Dr. S. W. Wheaton.

In accordance with instructions I visited the town of Ilkeston in Derbyshire (population, 19,744 in 1891) on September 22nd, 1893. I then ascertained that since September 9th four cases of acute diarrhœal illness were known to have occurred in the town, of which three had ended fatally.

The particulars of these cases are as follows:—

Case I.—L., male, æt. 56, was engaged in collecting nightsoil from privies in the centre of the town early in the morning of September 14th. While at work he was seized with diarrhœa, and returned from work to his employer's house in the town. At 9 a.m. he started to walk to his home, about three-quarters of a mile away, but fell down in the street, and was taken home in a cart. He arrived home about 11 a.m. Whilst in the town he called at one or more houses, and is thought to have used the privies at several houses. On reaching home he vomited repeatedly, and his bowels acted very frequently; the stools were at first of a light yellow colour, but soon became "like water." The last three stools that were passed, shortly before death took place, were slightly brownish in colour. He suffered from severe cramps in the abdomen, arms, and legs, his features became shrunken, the eyes sunken, and his face and hands blue and shrivelled; he died on the afternoon of the 15th. No post-mortem examination was made.

Case II.—A., a female, æt. 20 years, had been going every day to see her brother, Case No. IV., who had been ill for some time. On the evening of September 18th, while at her brother's home, she was seized with vomiting and purging, together with cramps in the legs and stomach, and at once started to walk home to her house, which was half a mile away, in the centre of the town. She arrived home about 11 p.m., and called at one house on her way, where she is believed to have gone to the privy. After arriving home the vomiting and purging continued; the stools, which at first were light yellow in colour, soon became "like "water with little shreds floating in it." The patient subsequently became cold and collapsed, the face and hands blue, the voice faint; and she died at 7 p.m. on the evening of September 19th. A post-mortem examination was made by Drs. Barwise, Carroll, and Badcock; and a portion of the ileum was removed and forwarded to Dr. Klein, who subsequently reported that as the result of microscopic and cultivation experiments, the evidence as to cholera was positive.

Case III.—F. (1), female, æt. 17 years, who was living in the same house as her brother, Case IV., and who was sister of Case II. This patient, on September 15th, had a slight attack of diarrhœa, which, on September 19th, became very severe, the bowels acting quite 12 times a day, and was accompanied by cramps in the abdomen and legs. On the 20th the patient was much improved, after taking medicine; and on the morning of my visit (September 22nd) had gone to work at a needle factory, although very weak and ill, and still suffering from looseness of the bowels. The stools throughout the illness had been passed into the privy, and their character not noticed, except that they were very offensive. I saw this patient, and found her still very weak and ill, with shrivelled hands, and general pinched and pallid appearance The pulse was 60, and very weak.

Case IV.—F. (2), male, æt. 20. This patient had been ill for seven weeks before September 9th, on which date, after being considered convalescent for one week, he was taken suddenly with vomiting and diarrhœa; the bowels were opened from six to seven times a day, the stools were watery and light yellow in colour; he continued to suffer from diarrhœa and vomiting until the evening of September 17th, when he died. The original illness was regarded by Dr. Badcock as enteric fever, but as to the nature of the illness which ensued after the period of convalescence he cannot express an opinion.

The symptoms and course of the illness of Cases I. and II. appear to have been indentical with those of Asiatic Cholera; with regard to Case III., there appears to have been nothing typical. With regard to Case IV., it certainly seems that the patient did not die from a relapse occurring during enteric fever; since the presence of repeated vomiting during the relapse of enteric fever is an extremely uncommon symptom, and there was no abdominal distension, nor return of fever. The Notification of Infectious Diseases Act is in force in the district of the Ilkeston Urban Sanitary Authority, but diarrhœa is not included among the diseases to be notified.

During August of the present year there has been only one death from diarrhœa, and four deaths from gastro-enteric catarrh; all the deaths have occurred in persons under the age of 12 months. In September, up to September 15th, there have been three deaths from diarrhœa, two deaths from gastro-enteric catarrh, all in persons below the age of 20 months; and one death (Case No I.) from cholera "Anglica."

I visited the houses at which the four cases of suspicious illness had occurred. The house in which Case I. occurred is one of four very dirty and dilapidated houses; the ground around these houses is unpaved and damp,—there is no drainage except by an open channel. The house itself was very dirty and the walls covered with dirt. The excreta had been thrown into a privy midden which was uncovered and contained a quantity of liquid filth. The bedclothes and clothes of the patient had been burnt, but the privy had not been emptied, nor any other measures taken.

Case No. II. occurred in one of a row of houses which are fairly clean; the drains were defective, with old bell traps; and there was a row of offensive privies eight yards away. The bedclothes of this patient had been burnt, but the nightdress and clothing had been washed at home. The privy midden had not been emptied nor any other measures taken.

Cases III. and IV. occurred in a house which was fairly clean inside, but damp, the drains were defective and caused marked nuisance, the gulleys not being trapped properly. There were two privies at the back of the house, one of them being only a yard away from it, and a large ashpit. The privy nearest the house was used by two households, and was of the tub, or pail, pattern, but the pail was not large enough, and the filth was said to overflow into the yard. Two yards away from the privies and ashpit is a bakehouse, the window of which faces them. The privies are frequently used by strangers who pass through the yard. The privy at this house had been emptied on the morning of my visit, but no further measures taken. I found on inquiry that there were no other cases of diarrhœa present in either of the before-mentioned households. I also found that all the households in which cases of choleraic illness had occurred used the town water and no other. The patients had not taken any fish or shell-fish recently, nor could I find any evidence of communication between them and any places where cholera had occurred.

The bodies of the two fatal cases had been wrapped in sheets dipped in a solution of carbolic acid and were buried in the cemeteries.

Excrement disposal in the town is effected chiefly by privy middens, and also by tub or pail closets. There were very large accumulations of filth in the privy middens at the time of my visit.

The water-supply of the town is obtained from the Nutbrook Canal, the Nutbrook, and the water pumped from disused coal "workings." The Nutbrook Canal falls into the River Trent. The water in the Nutbrook is obviously polluted by sewage. The Medical Officer of Health informs me that the Nutbrook is polluted by sewage from Heanor and Marpole, and is joined above the intake by the Stanley Brook, which receives both excremental pollution and house drainage. The water from these three sources is collected in a reservoir, and passed through filters of sand and gravel before being pumped into the mains. At the time of my visit nightsoil was being unloaded on the banks of the canal, and a quantity of it was entering the water. This nightsoil is brought in barges from Nottingham and other places. The surface of the filter-beds is "scraped" about once in ten days; the material of the beds appeared in September last not to have been changed for at least twelve months. Six cases of enteric fever had been notified in July, nine in August, and eight in September during the present year. I subsequently conferred with the Mayor, the Chairman of the Sanitary Committee of the Town Council, and the officers of the Sanitary Authority, and advised as to the necessary precautionary measures to be taken.

No. 13.

App. A. No. 13.

On a fatal case of Cholera in Fulham Workhouse; by Dr. Copeman.

Report on the Circumstances attending the Death from Cholera of an Inmate of the Fulham Workhouse; by Dr. S. Monckton Copeman.

A. B., female, aged 51, died at 4.30 a.m. on Monday, September 11th, 1893, in the infirmary of the Fulham Workhouse. Cause of death certified by Dr. Steer, the medical superintendent, as due to "Choleraic Diarrhœa."

On visiting the infirmary on the following day (September 12th), in accordance with instructions, I obtained the following particulars of the case:—

Clinical Symptoms.—From a pauper attendant I learnt that A. B. had apparently been in good health up to the morning of Sunday, September 10th, and had made no complaint of pain or diarrhœa previous to that date. The attendant referred to, who had worked in the ward in which A. B. used to sleep, further stated that the deceased woman got up about 6 a.m. on Sunday morning and dressed herself as usual without making any complaint. She breakfasted at 6.30 a.m. (bread, butter, and tea), but about 8.30 said that she felt sick and went to the watercloset attached to the laundry, where she vomited. She had no motion of the bowels at that time. She attended chapel at 10.30, and although she afterwards said that she had "felt bad," she did not go out during the service. Just previous to dinner at 12.15 she had another attack of vomiting. She had dinner in the hall (beef, bread, and potatoes), which she disposed of without apparent inconvenience. Shortly after dinner, according to Nurse Cole, an aunt of A. B.'s (who lives in one of the "cottages" for old married paupers) came to fetch her niece for a visit. A. B. had been there about an hour when her aunt requested Nurse Cole to go to the cottages, as she thought her niece was dying. Upon arrival there the nurse found A. B. lying apparently insensible in an armchair, and learnt that she had been attacked with vomiting and purging, and had made use of the "cottage" watercloset. Dr. Steer was then summoned, who ordered A. B. to be taken to the infirmary.

(From Dr. Steer I learnt that A. B., who was an able-bodied but weak-minded woman, had on one or two occasions previously been attacked with fainting fits.)

She had regained her senses before she was actually removed from the cottages to the ward, and on arrival in the ward about 3.30 p.m. she is said by the ward-nurse to have looked cold and blue, but she made no special complaint of pain. About 4 p.m. A. B. had an attack of diarrhœa, but as, in the temporary absence of the nurse, she made use of the watercloset the nature of the stools was not ascertained. While in the closet she nearly fainted, and so was speedily got back into bed, when she was given some brandy and water, and hot-water tins were placed at her feet. Dr. Steer also ordered for her some bismuth and opium mixture.

Shortly after the doctor had left the ward the patient complained of cramps in her legs, which were rubbed by the nurse. This pain continued with intermissions throughout the night, and there was also some pain in the stomach.

Prior to 7.30 p.m. she had vomited twice, the material which was brought up looking, according to the nurse, like a mixture of curdled milk and undigested food. Several hours later she vomited once more,

the vomit at that time being plentiful and resembling weak milk and water.

Her bowels were opened twice between 8 p.m. and midnight, after which she was purged at intervals of about five minutes or less between this time and 2 a.m., after which till 4.30 a.m., when she died, the purging almost entirely ceased. The motions, according to the nurse, resembled "water above with soft white flakes below."

When first admitted to the ward an attempt was made to take her temperature, but in vain. The thermometer used registered down to 95° F., above which the mercury could not be induced to move. It was therefore shaken down almost into the bulb, but again it had not appreciably moved after an interval of several minutes. About 9 p.m. the temperature had risen to 97·4° F., and shortly after death it was noticed that the body seemed very hot, but the temperature was not taken.

Post-mortem appearances.—A post-mortem examination was carried out about 10 hours after death by Dr. Steer. Dr. Shadwell of the Metropolitan Asylums Board was also present.

The features were pinched, the eyes shrunken, the lips and hands blue. The stomach, which contained a few ounces of fluid material, was removed for purposes of analysis, if such a course should subsequently be deemed advisable. The small intestine was injected in its whole length, its mucous surface being covered with a brown grumous material like altered blood. The large intestine was not so injected, and contained a semi-fluid material of lighter colour than in the small intestine. The gall bladder was full of stones. The urinary bladder was collapsed and empty.

Portions of the ileum and colon were sent to Dr. Klein for microscopical and bacteriological examination. He subsequently reported that the comma bacilli were present in quantity, and that a pure growth gave the typical cholera-red reaction.

Movements of A. B. antecedent to attack.—With regard to the previous movements of A. B. I learnt, from the master of the workhouse, that since December 7th, 1891, she had never been outside the house, and that from that time to the date of her attack she had never been known to have a visitor. Her only relatives besides her husband were apparently an old uncle and aunt living in the "cottages" attached to the house, of whom the former was suffering from senile dementia. Her husband was also in the workhouse, although in a different ward, and had not seen her for several months. She had occasionally seen her uncle and aunt, but as no one is known to have supplied them with money it is highly improbable that she could have obtained anything from them in the way of food or drink. Being able-bodied, her diet had been that of the other inmates of the house. Water was supplied from the mains of the West Middlesex Company. A. B. worked in the laundry, where the clothes of patients in the infirmary were washed. None of these, however, had recently suffered from disease of a similar character.

Action taken as to Notification, Disinfection, &c.—On the death of the patient, Dr. Steer notified the case as one of "choleraic diarrhœa," to Dr. Hill, who at the time was temporarily doing duty for Dr. Jackson, the Medical Officer of Health for Fulham, at the same time informing him as to the extremely suspicious nature of the illness. He also informed the Coroner, who ordered a post-mortem examination to be made and an inquest to be held.

With regard to disinfection, Dr. Steer informed me that, at his request, the master of the workhouse had ordered all clothing and

bedding which had been used by A. B. while in the house to be burnt, and that this had been done; also that all the remaining bedding used in the infirmary by A. B. had been soaked in a solution (1–1,000) of perchloride of mercury, and the small ward in which she was treated had been fumigated with sulphur. I further learnt that the bedding had been destroyed by fire.

I advised that further steps should be taken, which should include the scrubbing of the floor of the workhouse ward and of the small ward at the infirmary with solution of perchloride of mercury, as also the seats and floors of all the water closets A. B. could have used; and that the drains should be well flushed out with a large quantity of a similar solution.

No. 14.

Report upon a limited but extremely fatal Outbreak of Cholera which occurred in the North Bierley Urban Sanitary District; by Dr. H. Timbrell Bulstrode.

On October 5th, 1893, a communication was received by the Board from Dr. Logan, the Medical Officer of Health for the above district, stating that "An intensely virulent form of 'Choleraic Diarrhœa,' or "'English Cholera' has manifested itself, and been in progress for "fully ten days, causing the death of five people. The disease has "been characterised by severe choleraic symptoms from the commence-"ment in each case; in three, terminating in collapse and death in "from nine to twelve hours, in one, in two and a half days, and in the "other, after the lapse of about ten days."

"All who were attacked died (and being related, had more or less "attended on one another during their illnesses), with the exception of "one woman who is apparently suffering from an ordinary attack of "diarrhœa, and who is likely to recover."

Upon the receipt of this communication, a telegram was immediately despatched to Dr. Logan, requesting that, if possible, a small portion of the ileum of one of the fatal cases should be forwarded to Dr. Klein for bacteriological examination. Dr. Logan was also informed that a Medical Inspector would at once proceed to North Bierley to confer with him upon the subject of the outbreak. Acting upon instructions, I proceeded the same night to Bradford, and on arriving there discovered that the occurrence had already excited considerable attention. Early next morning I visited Dr. Logan at North Bierley; and from him, as also from Dr. Naylor, and other sources, I obtained the following particulars:—

The first patient to be attacked was E. W., a youth aged 20, who was by trade a fitter at the local railway works. He was said to have been a phthisical subject, and to have suffered for several months past from diarrhœa, probably tubercular in origin. Owing to the poor condition of his health he had, under medical advice, been recently staying at Southport, but on Monday, September 18th, he returned home. He seems at this time to have suffered from diarrhœa in a somewhat aggravated form, but owing to the fact that he was subject to attacks of this nature, but little moment was attached to it by his mother. However, on the night of Sunday, September 24th, she called on Dr. Naylor (the boy's medical adviser), and requested a dose of the mixture which by experience had proved efficacious in former attacks. The usual improvement did not, however, follow the administration of the medicine, and on Tuesday, September 26th, Dr. Naylor was asked to visit the boy. On doing this he found him in bed, in a state of collapse, with feeble, fluttering pulse, cold extremities, sunken eyes, weak voice, cramps in legs, temperature 95°, and passing rice water stools. Vomiting subsequently set in, at first coloured with bile, but afterwards clear and watery, the pulse disappeared from the wrist, the extremities became blue and cold, the abdomen was retracted, and the urine scanty. This condition of collapse continued for about three days, but at the end of that time the pulse began gradually to assert itself at the wrist, the body became warmer, the temperature rose two degrees, and the urine became re-established. Subsequently, however, due not unlikely to deprivation and neglect, the patient passed into a condition resembling

that of "cholera typhoid," and died in collapse on Tuesday, October 3rd. It was from this case that the piece of ileum was forwarded to Dr. Klein. At the autopsy opportunity only afforded a glimpse of the internal appearance of the intestine to be obtained, and it was described to me as presenting an injected and almost gangrenous aspect. Death was certified as due to (*a*) "Choleraic Diarrhœa"; (*b*) collapse and exhaustion.

Dr. Klein subsequently reported as to this case that the microscopical appearance was very suspicious, but that he had been unable to obtain the culture reactions of the comma bacillus. In reference to this, it may be added that the patient from whom the specimen was taken had been ill about ten days, and that the stage of reaction had intervened between the primary collapse and death. (*See* Dr. Klein's report, App. B., page 185.)

As far as the evidence goes, it was E. W. who was instrumental in either a direct or indirect manner in causing the other attacks now to be described. The family of which he was a member had been for some time prior to the outbreak in a condition of great destitution, owing to the commercial complications then prevalent in the district. It would seem in fact from the narratives I heard that they were more or less destitute of the bare necessities of life, and it was only after the father and mother had contracted and succumbed to the disease that the attention of the Sanitary Authority was called to the condition of the household, and public sympathy awakened in its favour. Even when the nature of the disease was suspected the terror of it was so great that the patients were for some time left in the care of a daughter aged 20, who was at Leeds at the date of my visit. The Sanitary Authority eventually sent in a "nurse," but I was informed on good authority that she was frequently discovered either asleep or inebriated. The above facts are of some importance as bearing upon the unique fatality of the outbreak.

The house in which the W. family lived was in no way remarkable as to its sanitary condition, and there was no overcrowding of houses in the neighbourhood. In the W.'s house, as also very generally throughout the district, excrement disposal was effected by means of privy middens. The water supply for the district was from the Bradford Corporation Waterworks. It should, too, be added that the several houses invaded were separated by considerable distances, and there was no connexion between them in the matter of drainage or excrement disposal.

M.W., aged 42. (Mother of E. W.)—Death certified as due to "choleraic diarrhœa." Mrs. W., who was nursing her son, was apparently in good health on the morning of September 26th. At noon, however, she was attacked with diarrhœa, cramps in her legs, and vomiting; her temperature was 94°. At three p.m. she was in a state of profound collapse, with sunken eyes, weak voice, and cold extremities. The collapse increased, and she died at 11 p.m. the same evening. In this case, as also in those next referred to, the condition of the patient precluded any accurate observations being made as to suppression of urine.

In this case it is obviously impossible to fix the limit of incubation of the disease, as the evidence before us does not suffice to show at what period E. W.'s discharges became specifically infective, or when Mrs. W. reacted to them. All one can say is that there is a probability, almost amounting to certainty, that the mother derived her attack from her son rather than from a common cause with him.

Mrs. L. (1), aged 47. (Sister of Mrs. W.)—Death certified as due to "choleraic diarrhœa" Mrs. L. had visited Mrs. W. during her illness and also assisted in preparing her for burial. At 8 p.m. September 28th, Dr. Naylor was called to Mrs. L., and on visiting her house discovered her to be in a condition of collapse, with a temperature of 94°. Her general state was described by Dr. Naylor as exactly resembling that of her sister Mrs. W. The patient's condition got gradually worse and she died at 5 a.m. September 29th.

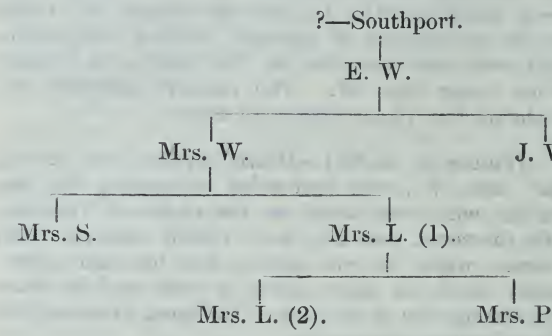
J. W., aged 42. (Father of E.W.)—Death certified as due to "choleraic diarrhœa." Mr. W., who had aided in nursing his son and presumably also his wife, was seized on the night of Thursday September 28th with diarrhœa, vomiting, and violent cramps. His voice subsequently became weak, his eyes sunken, and his skin sallow. He appears on Friday night to have rallied a little and to have maintained the improvement for some time. Collapse, however, set in again and he died on Sunday, October 1st.

Mrs. S. aged 41. (Sister of Mrs. W.)—Death certified as due to "cholera (English)." Mrs. S. had visited Mrs. W. during her illness and also assisted to "lay her out." She was apparently quite well up to the night of Tuesday (September 26th), when she went to visit Mrs. W., who was then ill. Next day (September 27th) she was, however, affected with diarrhœa, which continued onand off, but which did not entirely incapacitate her until the early morning of Monday, October 2nd, when she complained that her motions "were running away like water." She was at the same time attacked with vomiting, and the vomit was apparently of the same appearance as the motions. Subsequently cramps in her legs set in, her extremities became cold, and she died at noon Monday, October 2nd.

Mrs. L. (2), aged 72.—The patient had visited Mrs. W. and had also nursed Mrs. L. (1). Mrs. L. (2) visited Mrs. W. on September 26th, and on October 1st was taken ill with diarrhœa, the motions being "like thick beer." She, however, kept about until the following Thursday, October 5th, when the diarrhœa became worse, and vomiting and cramps supervened. I saw this patient on Friday, October 6th, at which time she was lying on her back in the bed in a collapsed condition, with a feeble pulse, sunken eyes, and cold extremities. I was unable to obtain at that time a sample of the motions, but I left with the medical attendant a wide-mouthed bottle, properly prepared, and requested that he would forward either a sample of the motions or a piece of the ileum according as to the opportunities which developed. He kindly forwarded a sample of the motions to Dr. Klein, who detected the comma bacillus by microscopical examination, and subsequently demonstrated its presence by means of cultivations. (*See* Dr. Klein's report, Appendix B., page 185.) Mrs. L. died on October 9th, her death being certified as due to "cholera."

Mrs. P., aged 66.—Mrs. P. assisted in "laying out" Mrs. L. (1). She was quite well until Sunday, October 1st, when she had pain in her abdomen and diarrhœa. On Thursday, October 4th, Dr. Naylor was called in to see Mrs. P., and visiting her found that she was afflicted with vomiting and diarrhœa, the stools, however, were semi-solid and light in colour. On Friday Mrs. P. was better, though the vomiting still continued. There was then no sign of collapse about her. Dr. Naylor wsa good enough to subsequently inform me that this patient rapidly recovered.

Diagram showing what was apparently the relation of the cases to one another.



It is of course quite possible that Mrs. S. and Mrs. L. (1) derived infection from E. W., who, it will be borne in mind, was a patient during the whole time Mr. J. W. and Mrs. W. were ill.

The origin of E. W.'s attack it was not possible to determine, more especially as those who could have afforded the most reliable information had all fallen victims to the outbreak. The girl who nursed the W.'s had, as already stated, at the time of my visit left the district, so that the evidence had to be culled to a large extent from second hand channels. It may be said that there was no evidence pointing to this outbreak having been caused by specifically polluted water, or by the ingestion of any food, or poison other than cholera, and indeed the history of the outbreak is far better explained upon an hypothesis of a highly infective diarrhœa of that class in which cholera is included than by any other.

Clinically, the symptoms were, in nearly every case not to be distinguished from true cholera, and it will have been seen that in the case of Mrs. L. (2) Dr. Klein was able to demonstrate, both by microscopical examination and by means of cultivation, the presence of the comma bacillus. In regard to case mortality this outbreak would compare with the most fatal of Asiatic cholera; but in judging of the nature of the complaint from this standpoint, the markedly depressing circumstances in which this neighbourhood, and especially the W. family, was at the time must be kept in view. Having regard to all the circumstances of the case it would appear that the only thing necessary to explain the outbreak upon a thesis of true cholera is that of its origin. Here, however, all attempts at solution were unavailing. There had been, it may be added, within two months of my visit some deaths of adults in the district from "cholera nostras" and "choleraic diarrhœa," but I was unable to trace any connexion between them and the cases under consideration.

* * * * * *

October 10th, 1893.

No. 15.

Report upon an Outbreak of Cholera at Tividale in the Rowley Regis Urban Sanitary District; by Dr. R. Deane Sweeting.

In obedience to instructions, I proceeded on September 26th, 1893, to Rowley Regis. I met that evening Dr. Beasley, the Medical Officer of Health to the Local Board, and Dr. Reid, the County Health Officer of Stafford. With them I visited some of the houses where reported cholera had occurred, and made some preliminary inquiries, which were further extended the next day.

Prior to my visit there had been in all six cases, two of them fatal. All had occurred in Tividale, (population, 1,697), an outlying colliery hamlet of the parish of Rowley Regis, adjacent to Tipton; five of them in one street, Lower Chapel Street, the other in Brown Lion Row some 40 yards away

The first case (*a*) was M. S. (æt. 60), wife of a watchman in Lower Chapel Street, who was subject to "stomach-ache" and diarrhœa, and who was easily upset by food. She was seized suddenly on Saturday morning, September 23rd, at 9 a.m. with vomiting and purging, cramps in the legs and stomach. Both vomit and stools were said to be dark and the latter watery. The medical man who saw her that evening found her almost pulseless, the extremities cold, the surface of the body blue, and she was suffering from intense cramps in the legs and abdomen. The skin was shrivelled, the eyes sunken, and there was well-marked "Vox cholerica." No stools were seen by the doctor, but the vomited matters were dark green and watery. She died at 1. 30 p.m. on Sunday (24th) after 23 hours' illness.

The next case (*b*) was A. T. (æt. 60), wife of a colliery labourer in Lower Chapel Street. She was attacked on Saturday night, September 23rd, at 9 p.m. with light-headedness, pain in the belly, cramps, vomiting, and purging. The diarrhœa was very profuse and watery, and lasted, along with the cramps and vomiting, until 5 a.m. on the 24th, when it ceased for a time. On Monday the 25th she was again purged twice. The stools were said to have been dark and watery; but none were seen by the medical attendant. This patient at the time of my visit was recovering, though still in bed on September 27th when I saw her.

The next case (*c*) was C. B. (æt. 47), the wife of a brickworker living in Brown Lion Row. She was subject to epileptiform fits. On Sunday afternoon, September 24th, about 4 p.m. she was suddenly taken with violent vomiting and purging, cramps (beginning in the feet and legs and passing up to the belly and arms), and blueness of the hands. The stools were noticed to be at first dark green, but afterwards much lighter. The medical man who saw her at 2.45 a.m. on the 25th found her in much the same state of collapse that he had found case (*a*). Here also there were marked cramps and "Vox cholerica." No vomit or stools were seen by me, but the former was stated to have been excessive in quantity, and the latter green in colour. C. B. died at 1.30 on Monday afternoon (25th) after about 21 hours' illness.

A portion of the intestine of this woman was sent to Dr. Klein who, after a bacteriological examination, was unable to distinguish the case from true cholera.

The next case (*d*) was W. H. M. (æt. 19), a colliery labourer, living in Lower Chapel Street. He was taken ill at midnight on Sunday September 24th whilst at work at the Pit Bank, with "violent pain in

the inside" and vomiting; purging set in, which continued all the night. He left work at 9 a.m. on Monday (September 25th), using a privy on his way home. The vomiting and diarrhœa continued all day Monday, until the evening. The motions were light and watery at first, slimy and dark afterwards. No flakes were noticed in them. There was no lividity in this case, and slight cramps supervened only after the cessation of the diarrhœa, viz, on Tuesday, September 26th. This young man at the time of my visit was downstairs and recovering.

The next case (*e*) was Mrs. B. (æt. 30), wife of a colliery labourer, living in Lower Chapel Street. She was suddenly attacked at 2 a.m. on Monday, September 25th, with purging, vomiting, pain in the belly, cramps in the belly and the legs. The stools were noticed by her to be light coloured and "yeasty." Dr. Beasley, who attended the case, speaks of them as being "the colour of mustard and the consistence of thin gruel." The last motion before my visit to her on the evening of the 26th was semi-solid. She was downstairs and convalescent on the 27th, though there had been some recurrence of loose motions that morning.

The last case of the series (*f*) occurred in a boy, N. S. (æt. 6 years), living in Lower Chapel Street. He is subject to diarrhœa, and has had frequent attacks of it. On Monday morning, September 25th, at 7 a.m., he was suddenly seized with severe purging and vomiting, which lasted until until 4 p.m. that day. There was headache and also some pain in the belly, but no cramps. The first two or three stools were noticed by the mother to be dark and slimy ("mud-like"); but they afterwards became lighter. He had apparently quite recovered at my visit, for his mother had sent him to school on the morning of the 27th.

The dejecta of all six cases had been thrown as soon as passed into the midden privy of the yard in which each occurred.

Though five of the six cases reported upon occurred in Lower Chapel Street, they were in four separate though contiguous yards of that street. With one exception, the houses invaded in the street were fairly clean and not overcrowded. The exception was a dirty, damp, dwelling containing three families in four rooms. All the four yards, however, exhibited seriously unwholesome conditions, such as unpaved and damp ground, open surface channels conveying slop-water to a foul ditch at the back of the street, overfull middens, and inadequate privy accommodation. As regards water, three of the houses were supplied with tap water from the South Staffordshire mains; one with this and with deep well water; the other with deep well water only. The deep wells mentioned (two in number) are but loosely steined. I saw signs of surface percolation into one of them, viz., that used by case (*f*). There had been two cases of (unreported) diarrhœa in the same yard as (*f*) about a month before, one of them attended by cramps.

Brown Lion Row (where Case *c* died) is one of the worst properties in the district. It is built up to within four feet of the bank of the Birmingham Canal, the interval being filled up with solid accumulation of old rubbish, which is close against the pantry windows of the houses in the row. The foundations of the houses are 10 feet below the top of the canal bank, the back of which is formed by loosely placed "cinder slag." The back walls of all these houses are damp; the flooring consists of broken bricks and earth; the roofing is defective, leading to the incursion of rain. Privy accommodation is inadequate, and a large but roofed midden, serving seven houses, is built up close to the end house of the row. Drainage is effected by open, often broken, surface channels in front of the houses, leading to untrapped gullies and grids, from

which the sewage is conveyed by a pipe under the road to a ditch in the field opposite.

Water is supplied to the houses in this row from a standpipe led from the South Staffordshire Company's mains.

The close connexion in time, as well as place, of these six cases is noteworthy. All six were attacked between 9 a.m. on Saturday, September 23rd, and 7 a.m. on Monday, September 25th, *i.e.*, within 46 hours. This, along with their proximity to each other, would seem to suggest some common and rapidly acting cause. I could get no evidence of importation from or of human communication with the places already known to be infected with true cholera. I made particular inquiry as to this with regard to places near by such as Derby, Leicester, Ashbourne, Mansfield, and Ilkeston, as well as ports of Hull, Grimsby, and Cleethorpes. Case (*d*) had partaken of some mussels at a fishmongers shop at Dudley on Saturday night, the 23rd. On inquiry at this shop I found that the fishmonger obtained his mussels from two salesmen in the Birmingham Market. I inquired there also, and found that mussels are usually obtained by them from Wales and from Holland. The "Dutch mussels" (of which I saw many exhibited for sale as such) come ordinarily by boat from Rotterdam to Hull and sometimes to Grimsby, and thence by rail to Birmingham. Occasionally they come *viâ* Harwich.

These and other salesmen in Birmingham fish market acquainted me with the fact that a great deal of their fish came from Hull and Grimsby; and that they were in the daily habit of selling it to small dealers who came in from the towns around. I learned that fish-hawkers frequented Lower Chapel Street and other parts of Tividale almost daily, and I saw one in the invaded street at my visit. It is a fact, too, that Cases (*b*), (*e*) and (*f*) (in Lower Chapel Street) had partaken of fish purchased from such hawkers a few days before their respective attacks, whilst Case (*c*) had not eaten any, except on one occasion ten days before. This was purchased from a small dealer in Oldbury who procured it from Birmingham. Case (*a*) had taken neither mussels nor fish.

Case (*d*) had recently returned from hop-picking in Herefordshire, and Case (*e*) from hop-picking in Worcestershire. The latter was said since his return to have eaten a great many apples that he brought with him.

None of the cases had been removed to an isolation hospital. The Authority possess one; but it was occupied by small-pox. Neither had the bodies of the fatal cases been removed to the public mortuary of the district, the reason alleged being that they were not known definitely to be cholera.

The midden at Brown Lion Row had been emptied and sprinkled with carbolic powder. The house in Lower Chapel Street where the fatal case had occurred was being disinfected by sulphur fumigation and washing with carbolic solution at the time of my visit. All evacuations from the patients were mixed with carbolic powder supplied by the Authority after the cases became known to them. I suggested that the bedding of the two fatal cases should be at once burnt, and this was done.

On September 27th, I attended a specially summoned meeting of the Local Board, and advised the Sanitary Authority as to the necessary precautions to be taken.

App. A. No. 15.

On Cholera in Tividale; by Dr Sweeting.

Additional Note by Dr. Sweeting with regard to the Outbreak at Tividale.

I paid a second visit to Tividale on September 29th, when I was made aware by Dr. Beasley, the Medical Officer of Health, of two fresh cases of suspected cholera at Tividale. They had both occurred in Brown Lion Row, where C. B. had died on September 25th.

The first case was A. R. M. (æt. 31), the wife of a brickworker, living a few doors from C. B.'s cottage. She was attacked on the morning of September 27th with headache, vomiting, diarrhœa, and some pain in the belly. She had no cramps and no blueness of the hands or feet or any other part of the body. The motions, when viewed by Dr. Beasley on the 28th, were light yellow in colour, and in consistence like gruel. The diarrhœa continued all that day, but the other symptoms gradually abated. When I saw her at 2 p.m., on the 29th, she was lying on the sofa downstairs. The motions were becoming more solid; but she had still some pain in the belly and felt sick.

I found that A. R. M. had been on intimate terms with C. B., and had run in and out of her cottage during the latter's illness. Further, A. R. M.'s mother, living next door, and frequently visiting her, had helped to lay C. B. out.

The second case was T. B. (æt. 5), son of C. B., and living in the same house. He was attacked on Wednesday night (27th) with vomiting, purging, and great pain in the bowels. He apparently had no cramps or lividity. Recovery was rapid, for when I saw him shortly after 2 p.m., on the 29th, he was sitting dressed in the downstairs room of the house to which he had been removed. Neither his stools nor vomit were seen by Dr. Beasley.

Bearing in mind their close connexion with C. B., it seems fair to assume that these two cases derived their infection directly or indirectly from her.

The cottage where C. B. died has been already described, that occupied by A. R. M. has similar accommodation, but is cleaner, less damp, is not built up to the bank of the Birmingham Canal, and there is more free air space at the back.

* * * *

No 16.

Report upon Two Deaths due to "Cholera" at Coton Hill Private Asylum, Stafford; by Dr. H. Timbrell Bulstrode.

In consequence of a telegram received on October 2nd, from Dr. George Reid, consulting physician to the Coton Hill Asylum, and Medical Officer of Health to the County Council of Staffordshire, that two deaths of a suspicious character had occurred at that Asylum; and in view of the fact that a microscopical examination of the intestinal contents of one case had been pronounced by Dr. Klein distinctive of cholera, I was instructed to proceed to Stafford and inquire into the circumstances of the case. I arrived at Stafford on the night of October 2nd, and on October 3rd had an interview with Dr. Reid, and Dr. Blumer, the Medical Officer of Health for Stafford Rural Sanitary District, in which the asylum in question is situated. From these gentlemen and from the Medical Superintendent of the asylum I learnt the following particulars:

The Coton Hill Asylum is situated on a well-elevated site of red marl, about 1½ miles from the centre of Stafford, and about 400 yards from the borough boundary. It contains some 136 paying patients.

Case No. 1 was that of a male aged 52, who had for the last 30 years been an inmate of the asylum. He was of a debilitated constitution, and was demented. On Tuesday, September 26th, at about 4.30 a.m., he was, without any "premonitory" diarrhœa, taken suddenly ill with vomiting and diarrhœa. At 8 a.m. he was in a state of collapse, but conscious, with cold clammy skin, pinched features, and cold extremities, pulse only just perceptible. The patient seemed also to have drawn up his knees, as if suffering from abdominal pain. His condition got gradually worse, in spite of stimulants and opiates, and he died at 9.40 p.m. the same day. The stools were described as having been at first "undigested food," but afterwards "clear and slimy." Those who saw them, including an old Indian servant who had seen many cases of cholera, did not regard them as "ricewater" in appearance. The vomit consisted, so I was informed, of "undigested food;" it was not bile stained. The temperature was sub-normal. At the autopsy it was stated that the intestines were distended, and that no ricewater contents were discovered. There was no sign of peritoneal inflammation. Peyer's patches were normal in appearance.

Case No. 2.—Male aged 56. Inmate of asylum for three years; feeble in health, a subject of chorea (but not taking arsenic), and "cerebro spinal sclerosis." Patient was in same ward as case No. 1.

This patient was taken ill with vomiting and diarrhœa between 5 and 6 p.m. on September 29th. The stools were yellow and fluid at first, but became more watery afterwards, and deposited a flocculent precipitate. The patient had apparently no cramp, and no pain after the first evacuation. The symptoms continued to increase in severity, and the patient died in collapse about 12.50 a.m. September 30th, after eight hours' illness.

At the post-mortem the intestines were stated to be collapsed against the vertebral column, and the bladder distended up to the level of the umbilicus. No other appearances seem to have attracted the notice of

the pathologists. It was from this case that a part of the ileum was sent by Dr. Reid to Dr. Klein. [Dr. Klein's investigations (*see* page 184) gave, both microscopically and culturally, positive evidence of true cholera.]

As regards the etiology of the two cases, it may be said that as both occurred in the same ward, and the interval between them was but short, it is not improbable that the second case was dependent upon the first, though no evidence was forthcoming on this point. Assuming, however, for the sake of investigation, that Case No. 2 bore no causal relation to Case No. 1, and that each was due to an independent, or to a common cause, it was not possible to establish the origin either of the one or the other.

As regards communication with any pre-existing case, either inside or outside the asylum, I was unable—as also were the medical men concerned in the inquiry—to obtain any clue. I inquired as to the visits of friends, the sending in of food, &c. to them, the visits of the attendants to towns infected with cholera, the source, as far as possible of all solid or liquid foods arriving in the asylum, more especially fish, tinned meats, milk, water; fruit, &c. As regards fruit, it may be mentioned that all the patients had eaten pears grown on the estate; but they appear to have been sound and not to have been indulged in inordinately. The fish to the asylum had previous to September 8th come from Grimsby, but all had been boiled and no shell fish had been eaten. I was unable to ascertain from the medical superintendent that there had been any cases antecedent to those under review, at all suspicious of cholera.

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No. 17.

ORDERS issued by the LOCAL GOVERNMENT BOARD on September 1st and 6th, 1893, putting in force EPIDEMIC REGULATIONS in respect of CHOLERA in GRIMSBY and CLEETHORPE SANITARY DISTRICTS.

I.

To the Urban Sanitary Authorities of Grimsby and Cleethorpe-with-Thrunscoe, and the Port Sanitary Authority of Grimsby;—
And to all others whom it may concern.

Whereas the Urban Sanitary Districts of Grimsby and Cleethorpe-with-Thrunscoe and the Port Sanitary District of Grimsby are now threatened with Cholera, We, the Local Government Board, in exercise of the powers given Us by the Public Health Acts, and any other Acts enabling Us in this behalf, do by this Our Order make the following Regulations, and declare the same to be in force in the said Urban Sanitary Districts and Port Sanitary District, and to apply to any vessels within the jurisdiction of the said Port Sanitary Authority.

In this Order the following terms shall, unless the contrary intention appears, have the meanings hereby respectively assigned to them; namely,—

The term "Local Authority" means Urban or Port Sanitary Authority of the said Districts.
The term "district" means the district of such Authority.
The term "house" includes any ship or boat.
The term "cholera" includes choleraic diarrhœa.
The term "guardians" means a board of guardians elected under the Poor Law Amendment Act, 1834, and the Acts amending the same, and includes a board of guardians or any other body of persons performing under any Local Act of Parliament, the like functions to a board of guardians under the Poor Law Amendment Act, 1834.

The Local Authority shall forthwith make arrangements for meeting daily, or, according to the exigencies of the district, shall appoint one or more committees of their body to meet daily, for the purpose of carrying the following regulations into effect, and shall see that the same are carried into effect so far as circumstances require. Each committee so appointed shall have all such powers of the Local Authority within the part of the district, or in relation to the special matters entrusted to them (including the power of incurring expenses and of appointing officers and of taking legal proceedings, but not the power of levying rates or borrowing money), as may be necessary for the purposes of these regulations; and in the followlng regulations the term Local Authority shall include any such committee:—

1. The Medical Officer of Health shall advise the Local Authority on all matters concerning the carrying these regulations into effect, and shall generally superintend the carrying out of the same.
2. In each district, or, if the quanity of work to be done renders it desirable to sub-divide the district, then in each of such sub-divisions, a legally qualified medical practitioner, herein-

after called the medical visitor, shall be put in charge of the district or sub-division for the purposes of these regulations under the superintendence of the Medical Officer of Health; and each such medical visitor shall be provided with all needful medical assistants and such other assistants as may be required for carrying these regulations into effect: Provided that every Poor Law District Medical Officer who shall not be appointed a medical visitor shall, *ex-officio*, be a medical assistant for his district or for so much thereof as is within the district of the Local Authority, and he shall be entitled to reasonable payment from the Local Authority for his services.

3. The medical visitor, or one of his assistants, shall, at least once daily, visit those parts of the district or sub-division which are inhabited by the poorer classes, or wherein the disease is present, and shall there inquire at every house as to the existence of cholera or diarrhœa, and shall enter in a report book to be kept by him for the purpose the facts as to all cases he may meet with; and shall, without delay, give, or take the proper steps for causing to be given, all necessary medical assistance to the sick. The medical visitor or assistant shall, when visiting the part assigned to him, be provided with medicines for immediate administration in urgent cases, and shall be held to be in medical charge (which shall include giving directions as to preventing the spread of the disease) of all cases of cholera or diarrhœa with which he may meet, unless or until other provision for their medical attendance be made. He shall also, so far as possible, when visiting such part, investigate whether any conditions dangerous to health exist therein, and in particular whether there is any accumulation of excremental or other filth, and whether any unwholesome water supply is in use.

4. Each medical visitor shall, by transmitting the report books kept by him and his assistants, or in some other way, report daily to the Medical Officer of Health, for the information of the Local Authority, the result of his own and his assistants' inquiries with respect to cases of the disease; and shall also report all unwholesome conditions which he or any of his assistants may have discovered, and shall make such other suggestions as to the state of the district or sub-division as he shall deem advisable.

5. Immediately on the receipt of any such report from a medical visitor, the Local Authority shall see to all unwholesome conditions mentioned therein being remedied, so far as possible: such measures of cleansing and limewashing as cannot otherwise be speedily effected being carried out at the cost of the Local Authority by persons employed by them; and the provisions of the Public Health Acts being put in exercise as regards other matters that can be dealt with thereunder; or as regards matters which are under the control of some other authority, notice being given to the person or body having power to deal with the same.

6. Each medical visitor shall, where needful for the purposes of these regulations, communicate to the relieving officer any case of destitution requiring relief of which he may have become aware.

7. The Local Authority shall, under the advice of the Medical Officer of Health, provide a sufficient number of dispensaries to be open night and day, at convenient places within the district,

with an adequate supply of such medicines, medical appliances, and disinfectants as the Medical Officer of Health shall recommend, and with a legally qualified medical practitioner or skilled assistant always in attendance at each; and such medicines, medical appliances, and disinfectants shall be dispensed without charge by such medical practitioner or assistant to persons bringing orders for the same from a medical visitor or his assistant, and to any other persons who need immediate medical treatment and by or on behalf of whom application may be made for the same. The names and addresses of all such other persons shall be sent to the medical visitor of the place in which they reside.

8. In every case of cholera or diarrhœa, where the patient is not otherwise under medical care and treatment, the Local Authority shall, with the utmost expedition, cause medical assistance to be rendered, as well as provide such aid and comfort, nourishment and accommodation, as the circumstances of the case may require.

9. The Local Authority shall provide competent nurses to aid every medical visitor in his attendance upon the patients suffering from the disease.

10. If fit and proper hospital accommodation for patients has not already been provided, the Local Authority shall, with all practicable despatch, provide such accommodation, and cause the same to be provided with such furniture, appliances, medicines, and other things as may be required to render the same ready for use, together with the necessary ambulances and litters for conveying the sick, and shall appoint a legally qualified medical practitioner, with or without assistants, and with the requisite nurses and attendants, as the case may require, to attend to the same: Provided that the Local Authority and any other Local Authority, and the board of guardians of any union or separate parish may co-operate in providing hospital accommodation, maintenance, and treatment for cholera patients, and in removing such patients to hospital.

11. If the Medical Officer of Health reports that houses of refuge for healthy persons living in infected houses ought to be established for the district, the Local Authority shall, with as much despatch as practicable, provide such houses of refuge, and furnish them with all needful comforts and appliances, and place them when occupied under continuous medical observation. If they remove thereto any or all of the healthy persons living in an infected house they may, if necessary, provide for the maintenance of such persons therein.

12. If the Medical Officer of Health or a medical visitor reports that in any dwelling where there is a case of cholera the sick cannot be properly separated from the healthy, and that any person suffering from cholera should be removed to hospital, such person shall be removed accordingly to a hospital for cholera patients. If the Medical Officer of Health or the medical visitor recommends that the sick person or persons be not removed, but that the healthy be removed, the Local Authority shall forthwith cause them to be removed to a house of refuge or to such other sufficient accommodation as the Local Authority shall provide for them.

13. The Local Authority shall, for use in or about dwellings where cholera or diarrhœa exists, provide proper disinfectants in

sufficient quantities for the purpose of disinfecting the discharges from the sick, and the utensils and water-closets or other closets or privies in which such discharges may have been received, and for effecting any other disinfection proper to be done in or about such dwelling; and the medical visitor or assistant or other person in attendance on the sick, shall give full and particular instructions as to the best method of using such disinfectants and shall so far as practicable see to the same being so used.

14. The Local Authority shall provide proper means for removing for the purpose of disinfection and for disinfecting articles of clothing, bedding, or furniture, and shall cause every article of clothing, bedding, or furniture which shall have been exposed to choleraic infection to be disinfected; or shall cause the same to be forthwith destroyed; and shall within a reasonable time replace all such articles or pay the reasonable value to the owner.

15. Every Local Authority, company, or person owning or having possession of any waterworks for the public supply of water shall cause the sources of water supply, filter beds, reservoirs, cisterns, pipes, pumps, and other apparatus belonging thereto, to be carefully examined, cleansed, and purified, and other necessary measures to be taken, so that the water may be supplied without impurity. The Local Authority shall, at their first meeting after the receipt of this Order, direct a copy of this regulation to be sent to each such company or person supplying water within their district.

16. If it appear to the Local Authority that any drinking water used in the district is polluted, or is in immediate danger of becoming polluted, they shall at once (in order to provide for the immediate necessities of the consumers of such water) take measures to provide wholesome water in its stead, and to prevent, as far as possible, the further use of the existing supply. For this latter purpose the Local Authority may close any public or private wells and prevent the use of water from any particular source.

17. The Local Authority shall make due arrangements with undertakers and with the authorities of churchyards, burial grounds, and cemeteries, and otherwise, so that interment or other proper disposal of the body may speedily take place in the cases of deaths arising from cholera, and shall, when informed of any such death, cause the corpse to be disposed of with the utmost despatch, and with such precautions as the Medical Officer of Health shall deem necessary.

18. Where any death shall occur from cholera, no collection of persons shall assemble in the room where the corpse is, and no "waking" of the dead shall be allowed.

19. The Local Authority shall cause the immediate removal from any room which living persons inhabit, of the corpse of every person dying from cholera, and provide for the proper custody of such corpse.

20. The Medical Officer of Health shall daily send by post to the Local Government Board a return of the number of cases of cholera which during the previous day may have come under the cognizance of the Local Authority, and of the number of recoveries and the number of deaths, with such other particulars as the Board shall from time to time require. The returns shall be in the following form, or to the like effect:—

Daily Return of cases of Cholera and Choleraic Diarrhœa in the District of the [*name of Local Authority*] for , the day of .

—	Cases.	Deaths.	Recoveries.
1. Number of cases included in previous returns which on the were remaining under treatment, and of the deaths and recoveries which have occurred amongst such cases on the -			
2. Number of *new cases* which have come under treatment on the , and of the deaths and recoveries which have occurred among such cases - - - -			
3. Number of cases *still under treatment* on the morning of the -			

Date , 189 .

(Signed)

Medical Officer of Health of the District.

21. The Local Authority shall from time to time as they shall find expedient or as may be directed by the Local Government Board, issue, publish, and distribute in placards, handbills, or otherwise, such admonitory notices as to sanitary conditions within the district, and such advice, directions, and instructions with regard to persons attacked with cholera, and such information as to the arrangements made for affording medical or other assistance in the district, as shall appear requisite.

Given under the Seal of Office of the Local Government Board, this first day of September in the year One thousand eight hundred and ninety-three.

(L.S.) Henry H. Fowler,
President.

Hugh Owen,
Secretary.

II.

To the Urban Sanitary Authorities of Grimsby and Cleethorpe-with-Thrunscoe, and the Port Sanitary Authority of Grimsby;—
And to all others whom it may concern.

Whereas the Urban Sanitary Districts of Grimsby and Cleethorpe-with-Thrunscoe and the Port Sanitary District of Grimsby are now threatened with cholera, and by an Order dated the 1st day of September 1893, We, the Local Government Board, issued regulations with respect thereto;

And whereas it is desirable that further regulations should be made as herein-after contained:

Now therefore, in exercise of the powers given Us by the Public Health Acts, and any other Acts enabling Us in this behalf, We do, by this our Order, make the following Regulations, and declare the

same to be in force in the said Urban Sanitary Districts and Port Sanitary District, and to apply to any vessels within the jurisdiction of the said Port Sanitary Authority :—

I.—This Order shall be read as one with the said Order of the First day of September, one thousand eight hundred and ninety-three, and the terms used herein shall have the same meaning as in the said Order.

II.—In any of the said districts where the Infectious Disease (Notification) Act, 1889, is not in force, the persons mentioned in section 3 of that Act and the Local Authority shall, under this Order, have the same powers and duties, in relation to the notification of cases of cholera as they would have under that Act if the same had been put in force as aforesaid, and choleraic diarrhœa had been an infectious disease to which that Act applied. In any of the said districts where the Infectious Disease (Notification) Act, 1889, is in force, the persons mentioned in section 3 of that Act and the Local Authority shall, under this Order, have the same duties in relation to the notification of cases of choleraic diarrhœa as they would have under that Act if choleraic diarrhœa had been an infectious disease to which that Act applied. The Sanitary Authority shall forthwith direct circular letters to be sent to all legally qualified medical practitioners in the district informing them of their duties under this Regulation.

Given under the Seal of Office of the Local Government Board, this Sixth day of September, in the year One thousand eight hundred and ninety-three.

HENRY H. FOWLER,
President.

(L.S.)
HUGH OWEN,
Secretary.

NOTICE.—Sections 136, 137, and 140 of the Public Health Act, 1875 (38 & 39 Vict. c. 55), provide as follows :—

The Local Authority of any district within which, or part of which, regulations so issued by the Local Government Board [*i.e.*, regulations such as those contained in the above Order] are declared to be in force, shall superintend and see to the execution thereof, and shall appoint and pay such Medical or other Officers or persons, and do and provide all such acts, matters, and things as may be necessary for mitigating any such disease [in this case cholera], or for superintending or aiding in the execution of such regulations or for executing the same as the case may require.

Moreover the Local Authority may from time to time direct any prosecution or legal proceedings for or in respect of the wilful violation or neglect of any such regulation.

The Local Authority and their Officers shall have power of entry on any premises or vessel for the purpose of executing or superintending the execution of any regulations so issued by the Local Government Board as aforesaid.

Any person who (1) wilfully violates any regulation so issued by the Local Government Board as aforesaid; or (2) wilfully obstructs any person acting under the authority or in the execution of any such regulation, shall be liable to a penalty not exceeding five pounds.

APPENDIX B.

Cholera in England in 1893: Observations by Dr. Klein on reputed Cholera Material submitted to him for Examination and Report.

App. B. No. 17.

Observations on reputed Cholera Material submitted for examination; by Dr. Klein, F.R.S.

Before discussing in detail the results of my examination of materials submitted to me from reputed cholera cases, I would refer briefly to the methods that I have adopted in my investigations. Such reference is, perhaps, the more desirable since the methods in question had regard always to need for prompt report by me as to whether the sample submitted did or did not indicate true cholera.

I. Methods of Investigation.

The proposition that the vibrio, known as Koch's comma bacillus, occurs in the intestine of acute cholera Asiatica, and does not occur in any other known acute intestinal disease of the human subject, is practically universally accepted; on this point all, or at any rate nearly all, pathologists are agreed. By "Koch's comma-bacillus" is meant a vibrio which differs from other species of vibrio occurring in the human intestine in the following respects:—*Morphologically, i.e.*, as regards size, shape, and motility: *Culturally*, growth in gelatine plates, in agar, in broth, on potato, in milk, and in peptone solution: and as regards its *Chemical Products*, nitrites and indol formation in broth peptone, or in peptone salt mixture.

This being the case, my examination of the materials submitted to me was mainly directed to ascertaining whether this species of vibrio was or was not present in the intestines or in the dejecta of the different cases. But, of course, when a specimen of bowel was in question, the condition of the intestine (ileum) was always noticed as a necessary preliminary step; since in acute Asiatic cholera the mucous and serous coats of the ileum are always found in a state of congestion, and the epithelium of the inner surface is either detached here and there over large or smaller areas, or is only loosely adherent to the mucous membrane. The congestion of the bowel is in some cases especially conspicuous about Peyers patches, which stand out markedly as deeply red projections; in other cases intense congestion is uniformly distributed over the mucous membrane, and in the latter cases the contents of the ileum are apt to be more or less blood stained. The procedure adopted by me in examination of cholera material was the following:—

(*a.*) *Microscopic Examination of the Contents of the Ileum, and of Dejecta.*

As is now perfectly well known,* Koch's vibrio is to be found in the so-called mucus-flakes in the ileum and in the rice water stools of typical (clinically) cases of Asiatic cholera. The vibrio, along with other bacteria, is present, sometimes in fair sometimes in small numbers; but in certain cases it occurs in such enormous quantity that not only the flakes but the fluid also in which they are suspended are literally crowded therewith, to the almost entire exclusion of other bacteria. Whether abundant or not, these vibrios can, in most cases, be easily recognised within the flakes in groups and in linear masses.

* Koch first announced the fact in July 1884, at the first Conference on Cholera-questions, Berlin.

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In fresh preparations the vibrios are at once conspicuous under the microscope by their curious screw-like movement, particularly when two vibrios are joined endwise forming an S-shaped body, and better still when they are forming a somewhat longer spirillum. By this peculiar screwlike movement they can, in the fresh state, be recognised in stools or intestinal contents that are by no means typical of cholera, as for instance in a more or less thin brownish fœculent fluid. In a microscopic specimen of the fresh material (particularly in the hanging drop) the vibrios, if present in a reasonable number (say several in each field of the microscope), can be easily picked out by this peculiar screwlike movement, even if there are present numerous other motile bacilli, such as proteus vulgaris or bacillus coli. But preparations made after the usual manner of coverglass films, dried and stained, have more often to be relied on. If an epithelial flake from the contents of a typical cholera ileum, or a similar flake from a typical rice water stool, be crushed and spread out in a thin film between two coverglasses, then dried, stained, washed, and mounted, it is found that such flake presents a very characteristic appearance. It contains the comma-bacilli—single commas or S-shaped forms—in groups and in linear masses. Koch graphically compares this arrangement to the manner in which a party of fish distribute themselves in a stream. This is well shown in Figures 3 and 4, Plate I., and in Fig. 13, Plate IV. When the appearances in the flakes (of the intestine or of the rice water stool) are of this character there can be no question as to the nature of the case; such appearances occur only in Asiatic cholera. On this point I think there is no divergence of opinion at present, and Koch's statement that a case that affords material presenting such appearances is true Asiatic cholera is, I consider, fully justified.

Unfortunately, however, even in true cholera, this appearance is not always found; in fact, only in a minority of cases does such condition obtain. Of above fifty cases that I examined during the occurrence, in 1893, of cholera in England, in fifteen only could the diagnosis of cholera justifiably be made at once solely from examination of coverglass specimens prepared in the above manner. More frequently, though the contents of the ileum were fairly typical (epithelial flakes in fairly clear fluid), the flakes and the fluid contained relatively few comma-bacilli recognisable with sufficient definiteness in stained coverglass specimens. On the other hand, numerous other bacteria, bacillus coli predominantly, were present in the flakes as smaller or larger clumps and masses, among which only here and there could a few comma-bacilli, in rows or in small aggregations, be recognised; whilst in the fluid containing the flakes only a few isolated comma-shaped bacilli amongst numerous other bacteria were detected. It is clear that from such microscopical appearances nothing in the shape of definite diagnosis could be ventured upon. The bare fact of the occurrence of comma-shaped bacteria similar in size, shape, and motility to Koch's vibrios, was all that could be stated. What were the biological characters of those comma-shaped organisms could obviously only be determined by growing them in suitable culture media. In yet another class of case—and in this class were the majority—the contents of the ileum or the dejecta submitted to me, though more or less fluid, were not of rice water character; they were perhaps brownish in colour, sometimes distinctly bloodstained. Such samples when examined under the microscope revealed in some instances epithelial flakes, in others no flakes at all; but all the coverglass specimens showed crowds of different kinds of bacteria, amongst which here and there a comma-shaped organism could often be recognised. In cases of this sort obviously further

observation of the material by culture in suitable media was of essential importance. But before proceeding to discuss cultural tests for the organisms present in the samples submitted to me, there will be advantage in referring in detail to some important and interesting facts that were ascertained as a result of my study of comma-shaped organisms in coverglass specimens.

In the cases in which the rice water stool, or the rice water like contents of the intestine, contained the commas in abundance, sometimes almost in pure culture,* coverglass specimens made of the fluid and of the flakes, dried and stained for ½—1 minute in anilinwater gentian violet solution † and absolute alcohol in about equal volumes, and afterwards well washed, dried, and mounted, revealed the interesting fact that not only the comma-bacilli themselves but their flagella also become distinctly visible as a result of the process. Figs. 1 to 10 (Plate I., II., and III.), show this very clearly. A large number of free flagella, some of great length (8 to 12 times as long as the comma-bacilli themselves) some shorter, are seen scattered about; either singly or in small groups, or in masses consisting of large numbers densely matted together. These free flagella are slightly wavy or spiral or twisted. Examining the specimens more in detail, here and there a comma-bacillus is seen to which one or two or even three longer or shorter flagella are still attached. Considering that in some parts of the flakes there are large masses of free flagella present and only a relatively limited number of commas or S-shaped forms, the suggestion arises that some commas possess more than one flagellum; and as a matter of fact it is not difficult to find grouped together two or three free flagella which seem to start from a common point and spread out in different directions. Now it is known from the observations of Löffler‡ that comma-bacilli from artificial cultures are found to possess a single flagellum only, and that this flagellum is not visible unless the sample of culture material be treated with a mordant previous to staining. It therefore follows that some of the comma-bacilli in the stools and intestinal contents differ from comma-bacilli derived from cultures in the fact of possessing more than one flagellum. That this is so, seems indicated from the manner in which the comma-bacilli of the stool or intestinal contents move in the fresh state. If a careful watch is kept on single commas, it is seen that some of them show their screwlike movement not in one direction only; they move in one direction for a space, then rapidly move in the opposite direction. This seems to imply that such bacilli possess at least one flagellum at each end. When S-shaped forms are watched they are sometimes seen after moving screwlike for a space in a given course, to suddenly swerve off at an angle to the direction in which they had been just moving. This would appear to indicate that one end or the other the S-shaped form possesses more than one flagellum. The same action is observed also of single commas. From the fact that the comma-bacilli of cultivation show in stained specimens their flagella only after the application—previous to the staining—of a mordant, whereas those of the stool or of the intestinal contents show their flagella by the simple process of staining, it follows that there must be present in the intestinal fluid some substance which acts like a mordant. I am not, however, in a position to say what such substance may be.

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* Hull (2), Grimsby (2), Rotherham, Westminster, Retford, Derby, Leicester, Yarmouth (2), Accrington, Balby, Rawmarsh, and North Bierley.

† Anilin water 100 parts, saturated alcoholic solution of gentian violet 11 parts.

‡ Centralblatt f. Bakt. and Parasit, &c., vol. VI., p. 219.

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The most perfect permanently stained specimens both of the comma-bacilli and of their flagella I have obtained from the rice-water stools. I take a flake of such a stool and stain it first bodily in the above anilin gentian violet solution for a few minutes; then after good washing in distilled water I crush it between two coverglasses so as to leave a thin film of the flake on each of these glasses; and finally I dry and mount in balsam. In such specimens the comma-bacilli and S-shaped forms appear of remarkable sharpness and are deeply stained; their flagella are very distinctly stained also, though they appear of a lighter colour. Figs. 1 and 2, Plate I., and Fig. 8, Plate II., show these points very well.

Now the easy way in which the flagella become stained in the above gentian violet dye, if a film only of the stool or of the ileum contents be used, has in several instances enabled me to foretell with certainty the presence in a particular sample of material of Koch's comma-bacilli. Thus, in certain stools or ileum contents, in which, on microscopic examination as dried and stained films, few distinct comma-shaped bacilli only could be recognised amongst crowds of straight bacilli, the presence of numerous stained free flagella of the same aspect as those found in preparations of typical rice-water stools, enabled me to say that there were most probably present in such specimens Koch's comma-bacilli. And on subsequent culture of the material in peptone solution my surmise was fully justified. I mention here, in illustration, two out of several instances:—As regards material from Fulham, the ileum contained a brownish slightly bloodstained fluid. In coverglass films, after staining and mounting, great numbers were noted of various sized, short and long, straight bacilli, with here and there one that not only looked curved like a comma-bacillus but in size was identical with the cholera vibrio. But in addition—and this was the remarkable feature of the specimen—there were present in great number free flagella. Fig. 5, Plate II., illustrates this. In it are seen a number of free flagella, though none of the bacterial forms in the particular field of the microscope can be identified as comma shaped. Here and there only, at other places in the specimen, a typical comma-bacillus occurred (some with a flagellum attached), but everywhere large numbers of the free flagella were met with. From this I felt almost certain that cultures would yield positive results as to the presence of the Koch's comma-bacilli, and this surmise was, by peptone cultures, proved to be correct. A Liverpool case was still more instructive. I received a piece of the ileum (ligatured at both ends) that had been kept in a sealed jar for nearly 10 days after death. On opening the intestine, which was much injected, no fluid was found in the cavity, but the epithelium was either loosened or in many parts quite detached. On making microscopic specimens, and staining them, there were seen amongst a large number of bacilli (bacillus coli and proteus) a considerable number of free flagella; only here and there could a bacterium be found which resembled a curved (comma-shaped) bacillus. Fig. 14, Plate IV., shows a considerable number of such free flagella, but in this field of the microscope no definite comma-bacillus was detected. In this case also the peptone culture yielded positive evidence of the presence of Koch's comma-bacilli. As will appear from my subsequent detailed description of the several samples submitted to me, other cases yielded the same proof of the correctness of my preliminary surmise, though, as will also appear from the detailed description, there were some cases in which such surmise was not verified by subsequent culture. At any rate this much may be said: If from typical stools or intestinal contents, specimens prepared and stained in the above manner show free flagella such as are depicted

in Figs. 1 and 8, Plates I. and II. respectively, peptone culture will in the majority of instances—notwithstanding that the number of curved bacilli (commas) amongst crowds of other straight bacteria appears altogether insignificant—prove the existence of Koch's comma-bacilli.

(*b.*) *Cultural Testing of Bowel Contents and of Dejecta.*

In those cases*, which presented under the microscope the typical appearances of Asiatic cholera—*i.e.*, crowds of Koch's commas in the mucus (epithelial) flakes, in some instances almost in pure culture—there was no difficulty in obtaining pure cultures of these commas by the following methods.

(*a.*) A particle of a flake from such a sample, placed in peptone broth and incubated at 37° C., yielded in 24 hours, in the superficial layers of the broth, an abundant crop. This, in the form of a thin pellicle, was, in most instances, practically a pure culture of the cholera vibrio; in any case, pure subcultures were easily made from this superficial layer.

(*b.*) By placing a particle of a flake from such sample in boiled salt solution or in broth, shaking it up, and then making by means of a platinum needle inoculation of gelatine or agar, with a view to plate cultivations. In such agar plates, after 20–30 hours' incubation at 37° C., numerous colonies of Koch's commas were to be found, from which subcultures were easily established. In the gelatine plates, after 2–3 days incubation at 20–22° C., numerous typical colonies of Koch's commas were obtained. They were noticed as small pits after 30–48 hours; during the third, and better during the fourth day, they were well marked by the liquefied condition of the gelatine about the colonies, and from these colonies subcultures were easily made.

(*c.*) By placing a particle of a flake from such sample direct into the Dunham peptone salt solution (1 p.c peptone, 0.5. p.c. sodium chloride), or by first distributing (or diluting) the flake in salt solution, and then, by means of the platinum needle, inoculating from this dilution other tubes containing the Dunham solution. The peptone solution, in whichever way inoculated, shows after 6–8–10 hours incubation at 37° C., a definite turbidity due to the rapid growth and multiplication of Koch's commas; and contains indol and nitrous acid, as is demonstrable by the addition of one or two drops of pure sulphuric acid, which produces the characteristic pale rose pink or "cholera red" reaction. (*See* Figs. 1(*a*), 2(*a*), and 3(*a*), Plate XIII.). This fact is justly insisted on, in confirmation of Dunham and Dunbar, by Koch, in his latest publication.† He points out that amongst the microbes which might become introduced into the peptone culture from the intestinal contents or stools (*e.g.*, bacillus coli, proteus vulgaris, vibrio of Finkler, &c.) there is no organism, except his cholera vibrio, which shows in this peptone solution, in so short a space as 6–12 hours at 37° C., rapid growth, and which at the same time affords the cholera red reaction. It is therefore obvious that this medium is for speedy diagnosis of the utmost importance.

In most of the above cases, where the flakes contained the comma bacilli almost to the exclusion of other bacteria, the peptone method enabled me to say within 16 hours that I was dealing with Koch's comma-bacillus. So, too, as will be shown presently, in many other cases where at the outset the comma bacilli were in a small minority as compared with other bacteria, the Dunham peptone salt medium

* As, for instance, cases from Hull, Grimsby, Westminster, Rotherham, Retford, Derby, Leicester, Yarmouth, Accrington, Balby, Rawmarsh, and North Bierley.

† Archiv. f. Hyg. and Infect., vol. XIV., p. 332.

was of immense service. It enabled me to obtain sometimes in 6–12 hours, at latest in some 16 hours, a crop of commas in the superficial layer of the peptone solution, from which further subcultures in fresh peptone salt solution (and other media) could at once be established; so that before 24 hours had elapsed since the commencement of the examination, pure subcultures and the cholera red reaction were obtained in secondary peptone tubes.

The broth-peptone cultures, on the other hand, succeed only where the comma-bacilli are from the first fairly abundant in the flakes; that is to say, one can secure in this way within 24–30 hours, a surface layer of pure culture of commas, and obtain also on the addition of sulphuric acid, the cholera red reaction. But in those cases where the comma-bacilli are comparatively much mixed in the stools or intestinal contents with other bacteria, this method fails to give positive result.

Gelatine plates, agar plates, agar surface cultures, gelatine stab and potato cultures, can as stated above be successfully established from the stools or intestinal contents if at the outset the comma-bacilli are predominating over other bacteria, or if at any rate they are fairly numerous as compared with others. In such case by diluting the materials (stool or intestinal contents), and then inoculating the above materials with a trace of the dilution, successful results are obtained. There is of course no difficulty in obtaining pure subcultures in all these media from a previous successful peptone culture; and a successful peptone culture, as has been stated above, is easily made even when the original materials contain only few commas.

In the latter cases, *i.e.*, where few commas were found in the materials, or even in cases where the microscopic examination failed to give definite evidence of their presence, inoculation of peptone-salt tubes yielded positive results in 6–12, at latest in 16 hours, whereas in like circumstances the cultures in all other media commonly failed. It is therefore with special reference to this class of cases that the peptone salt cultures proved of the highest value and importance.

It is not necessary to give here a detailed statement of the appearances of the colonies and of the growth of Koch's comma bacillus, since they have been so often described, and are so well known. It will suffice to restate their salient features from the point of view of my own observations:—

(1.) *In Dunham's peptone* (1 per cent. or 2 per cent.) *salt* (0·5 or 1 per cent.) *solution*, the cholera vibrio grows rapidly at 37° C., so that in no more than 6–12 hours the solution is uniformly slightly turbid. In 24 hours there is commonly an indication of imperfect thin film on the surface. The cholera red reaction (nitrite and indol) is found distinct as soon as turbidity is noticeable, provided that the culture is fairly pure as regards comma bacilli. There is, indeed, as Koch points out, no known organism except his vibrio which, in this medium, gives in so short a period the red reaction that is in question. But it needs to be insisted that pure sulphuric acid must be used. If the acid contains nitrites, a red reaction may result from the life processes in the peptone medium of organisms other than Koch's vibrio. It is true that in such case the colour does not persist, as does the true cholera-red; nevertheless it has ere now led to erroneous diagnoses. The precise tint of true "cholera-red" is a rose madder, faint in young cultures, more defined in older cultures. In Figs. 1(*a*), 2(*a*), and 3(*a*), Plate XIII., these different appearances are accurately represented after 24, 48, and 96 hours incubation at 37° C. It will be noticed that the depth of the tint varies in these periods; a deeper tint than the last is

not obtainable. As a matter of fact, the maximum depth of tint is obtained in four days' growth.

(2.) *In broth peptone*, the appearances are similar to those in peptone salt solutions, except that in the former no such rapid growth and no distinct cholera red reaction is obtained at such early periods as in the latter. After some (4–8–12) days' growth at 37° C., a thickish white pellicle is present on the surface of the broth; but in this latter respect the comma bacilli differ in the different cases, for while in some the pellicle is thick and coherent, in others it is only indicated as a thin scaly film, and in others again it is absent.

(3.) *In gelatine plate cultivations* incubated at 20–22° C. the colonies become marked, in 2–3 days, as minute grey dots situated in pits due to commencing liquefaction of the gelatine. Later, and as liquefaction proceeds, each colony presents a circular area of fairly clear liquefied gelatine, and in the central depression a whitish dot. This when viewed under a magnifying glass is seen to be made up of minute granules, densest in the centre and extending thence in less dense aggregation towards the periphery, but only about half-way thereto; so that the depressed liquefied area seems to be dotted with greyish granules like minute glass splinters. There exist considerable, and stable, differences in the amount and extent of this granulation, as also in the rapidity of the growth of, and the liquefaction by, the colony.

(4.) *In Agar Plates* incubated at 37° C., the colonies appear after 24 hours as greyish flat round dots; later they become thicker and larger, and when seen in transmitted light are light-brownish and granular. There exist also stable differences in these respects between the comma bacilli of different cases. In some the colonies remain small, greyish in reflected light, translucent and light brown in transmitted light; in others they soon become larger and whitish in reflected light, opaque and dark brown in transmitted light.

(5.) *In gelatine stab culture*, the growth first shows itself as whitish granules appearing after 24–28 hours along the line of the stab; then the surface becomes drawn in and funnel-shaped and occluded by an air-bubble, from which liquefaction gradually spreads towards the deeper parts. The liquefied gelatine is sometimes fairly but not quite clear, in others it is uniformly turbid; at the deeper parts of the liquefied portion there is a whitish granular deposit. When liquefaction has proceeded for some days a pellicle, at first thin and greyish afterwards thick and whitish, appears on the surface in some cases, but is absent in others. In 1891, on the occasion of the International Congress of Hygiene, I brought forward in the Bacteriological Section cultivations derived from Dr. D. D. Cunningham and obtained by him from cases of Asiatic cholera in Calcutta. Of these cultivations I maintained, as had Dr. Cunningham, that they show that the comma bacilli derived from different cases of Asiatic cholera belong to well-marked varieties; that is to say, as regards aspect and progress of the growth in gelatine plates and in gelatine stab cultures, the differences are of a stable character and do not merely occur now and again and indiscriminately. In the discussion which followed, Prof. Hueppe and Prof. Gruber maintained the contrary and denied that from these differences any conclusion as to different varieties can be drawn. Dr. Friedrich, of Berlin, to whom I sent subcultures of the different varieties, also opposed this conclusion. Now it has since been established by a variety of independent observers, including both Hueppe and Gruber that Cunningham's contention is perfectly correct. In a Paper published

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elsewhere on the Pathology and Etiology of Infectious Diseases,* I have given aseries of photographs and drawings illustrating Cunningham's different varieties of cholera comma-bacilli; and I can now, from the observations made on the cases of cholera occurring in 1893 in England, supplement my former contention by stating that culturally the comma-bacilli isolated from cases of cholera in England showed stable and marked differences. These, as far as they are apparent in gelatine stab cultures, are represented in the several drawings in Plates VII. to XII. inclusive. The differences presented in potato cultures will be presently described.

In further illustration of the stability, in the laboratory, of certain of these differences, I would especially note a case† amongst those examined by me in which comma-bacilli isolated by the peptone salt method behaved in morphological respects, in peptone culture, in cultures on agar and in broth, and as regards cholera red reaction, like Koch's cholera comma-bacillus; but nevertheless differed therefrom in the remarkable point that they did not liquefy gelatine in stab culture. Stab cultures in this medium made in September showed in November a line of granules in the track of the needle, but no trace of liquefaction. Broth cultures, agar cultures, and peptone cultures however made from such a stab culture behaved in all respects like Koch's cholera comma-bacilli, with inclusion of the cholera red reaction. Morphologically they were typical commas, S-shaped and spiral forms. Now the still more remarkable fact is that in gelatine plate cultivations made from such non-liquefying stab cultures the colonies showed a tendency to tardy liquefaction, but when from such a liquefied colony subcultures, whether on the surface or in the depth of gelatine, were made, there, was again complete inability of the organisms to liquefy the gelatine, though in other media they behaved like Koch's comma-bacillus. These subcultures were thoroughly tested for their purity, and the result was absolutely unequivocal. In some stab cultures showing for several weeks good and copious growth without trace of liquefaction, a disturbance by the sterile platinum loop of the superficial parts of the growth having been made, liquefaction, strange to say, at once commenced from the top and gradually proceeded towards the depth in the normal fashion. When liquefaction had thus well set in, new gelatine plate cultivations were made. In these subculture plates the colonies that made their appearance were all of the same kind, and liquefied the gelatine tardily as at first, with the ultimate result of producing typical colonies of Koch's commas. When, however, from such a colony new stab cultures were made in gelatine, though good growth occurred, again no liquefaction resulted. It ought to be stated that the nutritive gelatine was in all cases—both in this particular case and in the others—of exactly the same nature, and the methods used for making the cultures were exactly alike; yet there occurred this remarkable difference between the gelatine cultures of the particular case and of all the others. Though I cannot give an explanation of these differences, I am justified in saying that the comma-bacillus of the case in question is a distinct variety approaching those of some other cases in which liquefaction of the gelatine is conspicuously slower than normal.‡

It is noteworthy that Dr. Cunningham in his observations of the varieties of the comma-bacilli in Calcutta cholera cases, mentions one variety which failed to liquefy gelatine.

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* Part II. of Stevenson and Murphy's Treatise on Hygiene.

† From Southwark.

‡ Cases from Rawmarsh, Keighley, Grimsby, Yarmouth, and Hull (see Plates VII. to XII.).

(6.) *On potato.*—In the paper already referred to * I have given illustrations of the different varieties of cholera comma-bacilli, isolated by Dr. Cunningham, and I have now to add that the comma-bacilli from the cases in England, showed the same kind of appearances in their growth on potato. Inoculation of the surface of bits of potato (the potatoes were all exactly of the same kind, they were incubated at 37° C.) contained in test tubes were made from the various English comma-bacilli, and the result was that they produced in five to six days good, but colourless, growth, except in one case,† in which the growth was brownish, and in other three‡ in which the growth was faint yellow.

(7.) *In Milk.*—The typical Koch's comma-bacillus, when cultivated at 37° C. in normal alkaline milk previously sterilised, grows copiously, but does not produce any visible alteration in the physical characters of the milk; this retains, Koch says, indefinitely its fluid character. When, after two or three days incubation, new subcultures from such milk are established in the various media, pure crops of the comma bacilli are obtained. In all experiments with the comma bacilli obtained from the English cases, skim milk, sterilised and contained in test tubes, was used as a culture medium, and these tubes were then incubated at 37° C. The results were that, in the majority of instances, comma-bacilli which corresponded in all other respects to Koch's vibrio, were found to possess the power of sooner or later coagulating milk§

(8.) *Physiological effects on guinea-pigs.*—In my Report for 1892–1893‖ I have shown that though Koch's comma bacilli injected in large doses into the peritoneal cavity, as practised by Pfeiffer and Haffkine, produce acute intense peritonitis and death, this action is in no way specific or peculiar to Koch's comma-bacillus. Clinical symptoms and pathological appearances, in all respects similar, are indeed caused by a variety of other microbes, pathogenic and non-pathogenic, *e.g.*, the vibrio of Finkler, the bacillus prodigiosus, the proteus, the staphylococcus aureus, bacillus coli, and the bacillus of typhoid fever; though for production of fatal result, I had in all instances to inject large doses of agar culture distributed in bouillon into the peritoneal cavity, namely, $\frac{1}{8}$–$\frac{1}{2}$ the scrapings from a culture tube.

Now Koch in the publication, already quoted by me, states that one of the means of identifying his comma bacillus in a given case of disease, is injection of a culture of the organism isolated into the peritoneal cavity of guinea-pigs; and that his bacillus thus injected produces the death of the animal. But seeing that I have shown that other comma bacilli (vibrio of Finkler) and various other non-comma shaped bacilli produce exactly the same result, it must be clear that this method of identifying Koch's comma bacilli is of no real value. Moreover, Sanarelli in a recent important paper¶ shows that a number of species of comma bacilli isolated by him from various waters in and about Paris have more or less the same pathogenic action on guinea-pigs.

Koch also states that his comma bacillus, on intraperitoneal injection into guinea-pigs, produces the fatal result in very small doses,—a single platinum loop of an agar culture. This statement is, however, to me altogether surprising, since in no single instance

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* Stevenson and Murphy's Treatise on Hygiene.

† From Leicester.

‡ From Ilkeston, Coton Hill, and Accrington.

§ As for instance, Grimsby 2, Leicester, Retford, Kennington, Croydon, Tividale, Liverpool, Balby, Rawmarsh, Bingley, and Keighley.

‖ Report of the Medical Officer for 1892–93: Appendix B. pages 369–371.

¶ Annales de l'Institut Pasteur, November 1893.

out of the many cases in which the cholera comma-bacilli have been found by me in England was anything approaching this virulence noticed. The agar tubes were in each instance made from cultures of the same pedigree (the third or fourth remove); the agar surface of growth was 6 centimetres by 2; and in all cases after 48 hours growth at 37° C. the whole growth was scraped off the agar and distributed in sterile broth. In order to produce a fatal effect in the guinea-pig, it was necessary for me to use in some instances as much as one-fourth of a tube of an agar culture, in others as little as one-sixth or even one-ninth of a tube; but though one-ninth of a tube did on occasion suffice to produce a fatal result, the animals as a rule recovered.

Furthermore, I ascertained that the *same* agar cultures were not equally virulent with different guinea-pigs. Thus one sixth of an agar culture derived from a non-fatal Yarmouth case (No. 2) proved fatal in one animal, whereas one third of the same culture produced no result in another animal of the same weight which was injected at the same time. So, too, a culture from a fatal Fulham case proved non-fatal in the amount of one sixth of the tube at one occasion in one guinea-pig, while in another guinea-pig one eighth of the tube sufficed for fatal result. So that no definite law was to be found either as regards the relation of the virulence of the culture to the acuteness of the case from which it was derived, or as regards the uniformity of action—so far as quantity is concerned—of one and the same culture.

As to the character of the clinical and pathological symptoms produced in the guinea-pigs by these intraperitoneal injections, the distribution of the comma-bacilli in the peritoneal exudation and in the blood of the general circulation, with the identity in all these respects between the action of the cultures of cholera commas and of several other bacterial species, I have nothing to add to what I described and figured in my report for 1892–93.

II.—The Materials examined, and the Sources whence they were derived.

Having thus described all the essential points relating to the methods of examination adopted and the general results obtained, I now proceed to describe in detail the results of my examination of the several materials submitted. These will be taken in the chronological order in which the materials were received by me.

No. I.—Hull case No. 1.*—Received on August 28th from Dr. Mason the intestines of a boy J. H. F., who was taken ill at 6 a.m. on Thursday 24th August, and who died at 2.30 p.m. the same day. The intestine was much congested, and contained much rice water-like fluid full of greyish white flakes. These flakes examined under the miscroscope were made up of masses of epithelium detached from the mucous membrane. In stained preparations of these flakes, the appearances as regards number and distribution of the contained comma-bacilli were typical of cholera. Cultivations made in peptone salt solution, in gelatine plates, in broth peptone, and in agar plates, gave positive results. After 16 hours incubation the peptone salt solution showed pure culture of cholera commas, and gave the typical cholera red reaction. The gelatine and agar plates yielded also numerous colonies of cholera commas.

* Examined for the Hull Sanitary Authority.

No. II.—Grimsby case No. 1.* On August 30th, I received from Grimsby a bottle containing typical rice water stool, and, in another bottle, a piece of ileum of a woman who had died under suspicion of cholera. The rice water stool, as also the intestine, was characteristic of cholera. In both there was abundance of epithelial flakes which were found crowded with comma-bacilli. Cultivations of these proved typical in all media. Peptone salt solution, broth peptone, and gelatine plates, inoculated each with a particle of a flake previously shaken up in sterile salt solution, yielded pure cultivations of Koch's commas. Cholera red in the first peptone tubes taken, was very distinct after 16 hours incubation at 37° C.

No. III.—Grimsby case No. 2.* Received, 1st September, from Dr. Newby the ileum of a person supposed to have died from Cholera Asiatica. The contents of the gut were fluid and slightly tinged with blood; the mucous membrane was much congested, and the epithelium loose on the surface over large areas. In the contents were numerous epithelial flakes, crowded with commas. Cultivations in peptone salt solution yielded, after 12–16 hours incubation at 37° C., pure crops of cholera commas, and gave the characteristic cholera red reaction. Plate cultivations were made from the peptone tubes in gelatine and in agar; also stab cultivations in gelatine and inoculation of broth. In all these cultures pure growth of Koch's comma bacilli was obtained.

No. IV.—Hull case No. 2. The ileum of a woman (M.), who died under suspicion of Asiatic cholera, was received by me 1st September. The intestine and its contents proved typical of cholera. Epithelial flakes therefrom contained very abundantly comma bacilli, and cultivations in peptone salt solution and in gelatine plates showed them to be Koch's commas. Subcultures in all media were similarly typical.

No. V.—Rotherham case. Received on September 7th a piece of ileum of a man who died of supposed Asiatic cholera in a few hours. The intestine was congested and of a uniform rose colour. In the interior there was a solid mass of gelatinous material, in which under the microscope masses composed solely of epithelium could be distinguished. This condition of the intestine,—*i.e.*, presence of solid gelatinous masses—reminded me of a cholera case rapidly fatal that I had the opportunity of seeing while in India, in which there had been no purging; it was one of those rare instances of so-called "cholera sicca." In the gelatinous masses of the Rotherham case there were crowds of Koch's comma-bacilli; and, as gelatine plate cultures, cultivation in peptone solution, and cultivation on the surface of agar proved, they were present without the admixture of other organisms.

No. VI.—Westminster case. Mrs. B., cleaner in the House of Commons. Dr. Sweeting handed over to me on September 7th a bottle containing rice water-like dejecta, and a piece of ileum. The ileum was greatly congested, in its interior was rice water-like fluid. Numerous flakes in the stool and within the ileum were made up of epithelial cells, and contained Koch's comma-bacilli and S-shaped forms in crowds; grouped, too, in the characteristic arrangement. Figs. 3 and 4, Plate I., show this well. Similarly in the fluid of both stool and bowel contents numerous commas could be seen, and their flagella were brought out conspicuously by the staining process. The preliminary examination revealed then a condition such as is found in Asiatic cholera, and in Asiatic cholera only: Namely, the rice water-like stool, the congested ileum, its rice water-like

* Examined for the Grimsby Sanitary Authority.

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contents, the epithelial character of the flakes, and the crowds of the comma bacilli in them, in shape, size, and motility exactly like those seen in Asiatic cholera. The first series of cultivations of the flakes from this case in peptone salt solution, in agar, in broth, and in gelatine proved in all respects pure cultivations of Koch's comma-bacilli; and the peptone cultures gave very pronounced cholera red reaction. In this particular case the symptoms had been, as a matter of fact, strongly suggestive of Asiatic cholera. But had the clinical history of the case seemed to contraindicate cholera, or had the post-mortem examination seemed to signify death from some other cause, I should, from the preliminary microscopic and cultural examination—in fact from the former alone—have said, without the slightest hesitation that this woman was affected with, and had died from, Asiatic cholera. The whole pathology and the microscopic and cultural features of this case were in fact absolutely typical of a pure case of Asiatic cholera. It is unfortunate that the antecedent history of this woman remains uncertain that is to say, it has not been established by what means and in what way she contracted cholera. But this in no way cancels the evidence indicative of true cholera. All that we know as positively indicative of cholera was found here; no one has yet found in any known acute disease of the intestine, except in Asiatic cholera, this association of facts; namely, rice water stools; a congested intestine; rice water-like contents of the intestine; and epithelial flakes in the stools and intestinal contents crowded, almost in pure culture, with comma-shaped and S-shaped organisms, which in morphological and cultural respects completely resemble Koch's comma-bacillus.

No. VII. St. Bartholomew's Hospital case No. 1.*—Henry J., *æt.* 24. Patient was taken ill at Clerkenwell on the morning of September 8th, with sickness and severe diarrhœa; stools rice water-like, cramps very pronounced. The fluid rice water stools contained flakes; but these were not epithelial, only leucocytes and mucus. In the material a few free flagella, and some suspiciously comma-shaped-looking rods were observed, besides crowds of bacillus coli. Cultivations, however, proved negative as to comma-bacilli. The patient after being taken into the wards of St. Bartholomew's Hospital soon recovered.

No. VIII. Doncaster case. — Received from Doncaster on September 9th a piece of ileum ligatured at both ends. Unfortunately the intestine had been placed the day before in a bottle of spirit. On opening the intestine there was in it a brownish slightly blood-tinged fluid. On microscopic examination numerous epithelial flakes and a fair number of comma-shaped and S-shaped forms, besides other bacteria, could be recognised. Cultivations were made, but they all proved sterile; the bacteria in the intestinal fluid had been killed by the spirit in which the bowel had been preserved.

No. IX. Boston case.—Ileum and colon (of a woman 47 years old) received on September 9th. The bowel contents comprised numerous epithelial flakes, in which were many comma-shaped bacilli and also other bacteria. Cultivations were made which proved positive. Peptone cultures yielded after 16 hours at 37° C. abundant crops of comma bacilli, and afforded also the cholera red reaction. Subcultures made in the different media, all showed the commas to be identical with Koch's comma-bacillus.

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* Examined for the London County Council.

No. X. Morton (Gainsborough, R.) case.—Received on September 11th a piece of ileum and colon of J. R. In the intestinal contents were numbers of epithelial flakes, which, as stained cover-glass specimens, showed numerous free flagella, and a few comma-shaped organisms, besides crowds of straight bacilli. Peptone salt cultivations yielded positive results, and subcultures therefrom produced pure cultivations of Koch's comma-bacillus.

No. XI. Willesden case.—Received on September 11th a bottle containing fluid greyish brown dejecta of Mr. E., aged 60 years. Microscopic examination yielded doubtful result; cultivations also proved negative. It ought to be stated here that this stool was voided on the sixth day after commencement of illness.

No. XII. Leicester case.*—Received from Dr. Priestley on September 11th a piece of intestine (ileum) derived from a reputed cholera case. The contents were fluid and sanguineous; the intestine itself was much congested. Microscopic examination of the contents of the ileum showed epithelial flakes with crowds of commas and S-shaped organisms; in the fluid numerous other bacteria. Cultivations of flakes in peptone salt solution proved positive. Subcultures from these showed the bacilli to be Koch's commas.

No. XIII. Handsworth (Yorks) case.—Received on September 12th from Dr. Scott a piece of ileum. The intestine contained mucoid fluid matter full of epithelial flakes with crowds of bacteria, amongst which some that might be comma-bacilli. Cultivations in peptone salt solution yielded positive results. Subcultures therefrom made in the different media demonstrated the presence of Koch's comma-bacill.

No. XIV. Retford case.—Received on September 12th a piece of ileum, distinctly congested, in the cavity of which there was typical rice water-like fluid. On microscopic examination numerous epithelial flakes were seen. Both the fluid contents of the bowel, as also the flakes, contained comma-shaped and S-shaped bacteria in almost pure cultivation. Cultures from the flakes made in peptone salt solution, in gelatine plates, on the surface of agar, and in broth peptone yielded pure cultures of Koch's comma-bacillus.

No. XV. Fulham case.—Received on September 12th, through Dr. Copeman, a piece of ileum and cœcum of a woman, who died with suspicious symptoms in the Fulham Workhouse Infirmary. The intestine was deeply congested; its contents fluid, like pea-soup, showed under the microscope numerous epithelial flakes. These contained crowds of bacteria, amongst them a few comma shaped forms and numerous free flagella (*see* Fig. 5, Plate II.). Cultivations in peptone salt solution yielded positive result in 16 hours. Subcultures therefrom in the different media yielded pure crops of Koch's comma-bacillus; cholera red reaction in peptone cultures well pronounced.

No. XVI. Clacton-on-Sea case.—Rice water-like stool (from Kate W., 10 years of age) received on September 12th. It contained numerous flakes, not epithelial; they were made up of leucocytes. The fluid and flakes appeared on further examination to be pure cultures of bacillus coli; in the flakes, for instance, there were streaks and connected masses of this organism. Cultivations yielded negative results; no comma-bacilli appeared, only colonies of bacillus coli.

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* Examined for the Leicester Sanitary Authority.

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No. XVII. Kennington (Lambeth) case.*—Received on September 12th, from Dr. Hamer, a piece of ileum of Thomas E. Gut much congested; its contents fluid grumous; numerous epithelial flakes, containing amongst crowds of straight bacilli some distinctly comma and S-shaped forms. Cultivations in peptone salt solution yielded at once (in 16 hours) crops of comma-bacilli, which in subcultures in the various media proved identical with Koch's commas. Distinct cholera red reaction obtained.

No. XVIII. Ashbourne case.—Received on September 13th, from Dr. Littleton, a piece of ileum of a person who had died, it was suspected, of cholera. The intestine was much congested; its interior was filled with gelatinous material, in which numerous greyish white filaments and membranes could be distinguished. In the numerous epithelial flakes were crowds of bacteria, amongst them some few undoubtedly comma-shaped organisms. Cultivations in peptone salt solution positive. Subcultures from these all yielded pure crops of Koch's comma bacillus.

No. XIX. Mitcham (Croydon, R.) case.—Received on September 14th a bottle containing evacuations (of H. B.) washed out of a soiled sheet. Microscopic examination showed amongst crowds of cocci and straight bacilli a few undoubted comma-shaped bacilli. Cultivations made in peptone salt solution proved negative as to commas. (*See also* No. *XXI.*)

No. XX. Mansfield case.—Received on September 15th a stool voided on September 12th by a patient ill with suspected cholera. The stool was fluid, like pea-soup. Microscopic examination showed amongst a crowd of bacillus coli a few suspicious, *i.e.*, comma-shaped bacilli. Peptone salt cultivations proved negative. Two gelatine stab cultures made at Mansfield by Mr. C. Wills each contained a pure growth of bacillus coli.

No. XXI. Mitcham (Croydon, R.) case. (*See also* No. *XIX.*)—Received September 15th a piece of intestine and a stool. The intestine was congested, and contained a brownish fluid; this was also the character of the stool. Microscopic examination showed amongst crowds of straight bacilli a few that were distinctly comma-shaped. Peptone cultivations were made both of the intestinal contents and of the stool, but they proved negative; no cholera commas appeared.

No. XXII. Croydon Borough case.—Received on September 15th a piece of ileum and a fluid stool of a person supposed to have died from "English cholera." The intestine was injected, and contained brownish fluid matter; the stool was fluid and brownish. Microscopic examination showed both in the intestinal contents and in the stool numerous epithelial flakes, and amongst crowds of different bacteria some distinctly comma and S-shaped forms. Also there were numerous free flagella. Cultivations made of the intestinal contents and stool in peptone salt solution yielded good crops of commas. Subcultures proved these to be Koch's comma-bacillus. Cholera red reaction pronounced.

No. XXIII. St. Bartholomew's Hospital, case No. 2* (E. C. E., *æt.* 5).—A fluid rice water-like stool voided on September 15th, by a schoolboy

* Examined for the London County Council.

brought into hospital from St. Luke's, suffering with severe sickness and purging. The stool contained numerous flakes, but these were not of epithelial character. Amongst a crowd of various baciili there were some few that looked like commas, and also a few free flagella. Cultivations in peptone salt solution did not yield comma-bacilli. The patient recovered.

No. XXIV. Derby case.—Received on September 16th, part of the ileum of woman who had died with symptoms which Dr. Ernest Taylor, the medical attendant, had pronounced typical Asiatic cholera. The intestine was much congested, and contained rice water-like fluid, with numerous flakes made up of epithelial cells. In the flakes were crowds of comma-shaped and S-shaped organisms, in some places in pure cultivation. In arrangement, aspect, size, and motility they could not be distinguished from Koch's comma-bacilli. Cultivations were made in peptone salt solution, in broth, on agar, and in gelatine plates, and they all proved positive. The cholera red reaction in the peptone cultivations was very pronounced.

No. XXV. Stockton-on-Tees case.—Received on September 16th a piece of ileum. The intestine was congested, and contained pea-soup-like fluid. Microscopic examination showed numerous epithelial flakes, with crowds of various bacteria; but nothing definite as to comma-shaped bacilli could be made out. Cultivations proved negative as to comma-bacilli.

No. XXVI. St. Bartholomew's Hospital, case No. 3* (J. E. F., *æt.* 11). —On September 18th received rice water-like evacuations of a case that had been brought from Clerkenwell to the hospital with symptoms of cholera. The stool contained, in slightly turbid fluid, numerous whitish grey flakes, which, on examination, proved to be made up, not of epithelium but of leucocytes; no definite commas. Cultivations proved negative as to comma-bacilli. A rice water stool of the same case was obtained on September 19th. Greyish white flakes were numerous in it; they were not of the epithelial character, and neither they nor the fluid part of the stool contained definite comma-shaped bacilli, though there were crowds of bacillus coli. Cultivations proved, as before, negative. The patient recovered.

No. XXVII. Accrington case.—Received on September 19th a fluid stool that had been voided by an adult male on September 15th. The microscopic examination showed numerous epithelial flakes, and in them abundance of comma-shaped bacilli and S-shaped forms. Cultivations in peptone salt solution proved positive. Subcultures from these yielded typical Koch commas. Cholera red reaction distinct.

No. XXVIII. Newington (London) case.*—Received on September 19th part of the ileum of a woman (S. B.), who had died with suspicious symptoms. The intestine was much congested, and contained solid gelatinous stringy masses. Microscopic examination showed numerous epithelial flakes, with crowds of bacillus coli but no definite commas. Cultivations made in various media (gelatine plates, agar plates, peptone salt solution, broth peptone) all proved negative; no comma-bacilli made their appearance.

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No. XXIX. Blackburn case.—Received on September 20th, a pea-soup-like fluid stool of a person C. It contained crowds of various bacilli and of cocci; no definite comma-shaped organisms amongst them. Cultivations proved negative as to cholera commas.

No. XXX. Ilkeston case.—A. A., *æt.* 20, died September 19th. Received September 21st a piece of ileum, distinctly congested. Contents a brownish fluid, with numerous flakes of epithelial character, crowded with masses of cocci; here and there an undoubted comma-shaped bacillus. Cultivations in peptone salt solution yielded at once positive results. Subcultures in the different media produced crops of Koch's comma-bacillus. Cholera red reaction distinct.

No. XXXI. Liverpool case W. T. C.—Received on September 21st a fluid brownish stool, and a piece of intestine. The stool had had glycerine mixed with it, and the intestine had, after being opened, been placed in glycerine. In the stool there were found amongst crowds of different bacteria a few comma-shaped bacilli. The intestine was much congested, and flakes lifted from the internal surface showed in microscopic specimens a few undoubted commas. Cultivations were made in peptone salt solution, in gelatine plates, and in agar plates, but they all remained sterile; no growth of any kind appeared in them, thus showing that all the bacteria in the specimens had been killed by the glycerine. (*See also No. XLI.*)

No. XXXII. St. Bartholomew's Hospital, case No. 4.*—On September 21st a boy, (A. B., aged 15), was admitted from Penge (Lewisham) with suspicious symptoms and voiding copious fluid stools. Microscopic examination showed numerous flakes, but not epithelial in character they were crowded with bacillus coli. No definite comma-shaped bacilli. Cultivations proved negative. The patient recovered.

No. XXXIII. Appleton-le-Street (Malton, R.) case No. 1 (B. E.).—Received on September 22nd a fluid stool and a piece of ileum; the latter contained greyish semi fluid material. There were found both in the stool and in the intestinal contents numerous epithelial flakes, containing (especially the stool) numerous typical commas. Cultivations made in peptone salt solution yielded at once positive results. Subcultures in all the usual media afforded typical crops of Koch's comma-bacillus. Distinct cholera red reaction obtained in the peptone cultures.

No. XXXIV. Appleton-le-Street case, No. 2, G. B.—Received on September 22nd a brownish fluid stool; full of bacillus coli; with some few suspicious commas. Cultivations proved negative.

No. XXXV. Hackney case.*—Received on September 22nd from Dr. Wharry a typical rice water stool, voided on September 18th, by a patient (Thomas S.). The stool contained numerous whitish grey flakes which under the microscope did not show any epithelial cells. These flakes contained crowds of straight bacilli. Cultivations were made, but all proved negative. The patient recovered.

No. XXXVI. Great Yarmouth case No. 1.—Received on September 25th from Dr. Wrigley a piece of ileum of A. J. M., *æt.* 13, who had died September 22nd at 2.30 p.m. The intestine was congested

* Examined for the London County Council.

and contained gelatinous semi-fluid material. In this, under the microscope, extensive epithelial masses were found, which contained comma-shaped and S-shaped bacteria in great abundance and in the characteristic distribution. Cultivations were made, after a flake had been shaken up in sterile salt solution, in peptone salt tubes, in gelatine plates, in agar plates, and in broth peptone. In all these media pure crops of Koch's comma-bacillus were obtained.

No. XXXVII. Appleton-le-Street case No. 3.—Received on September 26th a dark brown fluid stool, voided by Mrs. R. on fifth day of her diarrhœa attack. The patient had been treated with large doses of carbolic acid and was recovering. The stool smelled distinctly of phenol. Microscopic examination showed, amongst large numbers of bacillis coli, a few suspicious-looking curved bacilli. Cultivations were made in peptone salt solution. They all remained sterile; no growth whatever appeared in them. It is, therefore, probable that the carbolic treatment had killed the bacteria; not only the comma-bacilli, if such were present, but also bacillus coli.

No. XXXVIII. Tividale (Rowley Regis) case.—Received on September 27th the ileum of C. B., *æt.* 47. The intestine was congested, and contained a peasoup-like fluid. Under the microscope there were seen numerous epithelial flakes, and in them crowds of comma-shaped bacilli and S-shaped forms. Cultivations in peptone salt solution produced good crops of Koch's comma-bacillus. Cholera red reaction distinct. Sub-cultures in the different media yielded pure growths of Koch's commas.

No. XXXIX. Southwark (St. George-the-Martyr) case.*—Robert W., *æt.* 60. Received, on September 27th, from Dr. Hamer a piece of ileum of the above case. The mucous membrane was deeply congested, the Peyers patches and solitary follicles very prominent, and deeply congested. The contents consisted of brownish fluid. On microscopic examination there were observed numerous epithelial flakes crowded with different bacteria, amongst which were fairly numerous commas and S-shaped forms; also free flagella. Cultures in peptone salt solution yielded at once crops of comma-bacilli. In peptone subcultures the cholera red reaction was very pronounced. The peculiar character of the growth in gelatine of the comma-bacilli obtained from this case has been already referred to; in the gelatine plate cultivations liquefaction was extremely retarded, and in gelatine stab cultures no liquefaction took place for some considerable time. Sections made, after hardening, through the congested mucous membrane of the bowel showed bacteria of different sorts situated in an almost unbroken layer on the surface of the mucosa, which was denuded of the epithelium; and showed also these organisms extending into the disorganised Lieberkuhn's follicles, and into the tissue of the mucosa. In some places comma-bacilli and S-shaped forms were found scattered and in clumps without admixture with other bacteria. (*See* Figs. 24 and 25, Plate VI.)

No. XL. Great Yarmouth (case No. 2).—Received through Dr. Copeman, on September 29th, a rice water-like stool of S. A. P., *æt.* 9. The stool consisted of slightly turbid colourless fluid, in which were suspended numerous greyish white flakes. These flakes were made up of epithelium. Both the flakes and the fluid in which they were suspended were literally crowded with Koch's commas, and, as far as appearances in cover-glass specimens went, were pure cultures of

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this bacillus. (*See* Figs. 6 and 7, Plate II.). Cultivations made in the several different media direct from this stool produced pure crops of Koch's comma-bacillus. This, therefore, was one of the minority of cases in which the stool was a pure cultivation of Koch's cholera commas. It was in fact the most typical case as regards numbers of these commas. And it was at the same time the only rice water stool in which, after filtering off the flakes, the fluid part of the specimen itself gave, on the addition of a few drops of pure sulphuric acid, a faint but distinct cholera red reaction. The patient recovered.

No. XLI. Liverpool case.—W. T. C. (*See also No.* XXXI.) Owing to the unsatisfactory state of the intestine (which had been cut open and placed in glycerine), received by me 21st September, a sealed jar was forwarded to me from Liverpool on September 29th, containing a piece of intestine from the same case. This jar had received the piece of intestine now in question on September 19th, and had been kept sealed for 10 days. On opening the intestine (September 29th) I found its mucous membrane congested but no fluid in it; the epithelium was loosely attached to the mucous membrane, and easily came off in large masses. Microscopic examination showed, amongst numerous specimens of bacillus coli and proteus, a fair number of comma-bacilli and a considerable number of free flagella. Cultivations were made in peptone salt solution, and these yielded at once a crop of Koch's comma-bacillus. Subcultures made therefrom in the several different media produced pure growths of typical cholera comma-bacilli. The cholera red reaction in the peptone cultures was very pronounced.

No. XLII. Malling (R.) case.—Received on September 29th a piece of bed sheeting, supposed to have been saturated with the rice-water discharges of a patient (E. F., *æt.* 43) who had died with suspicious symptoms. The stained portions of the sheeting, to which adhered a few flocculi, were put in sterile salt solution, and from this mixture coverglass specimens were made. Result, doubtful. Cultivations were made at the same time, but they all remained sterile; no growth of any kind appeared in them. It ought to be stated that the sheeting smelled strongly of phenol, and it is therefore probable that all organisms in the specimen had been killed thereby. Hence, perhaps, the sterility of the inoculated media.

No. XLIII. Coton Hill case.—On October 2nd I received from the Coton Hill Asylum (Stafford R.) a piece of ileum of a male, *æt.* 56. This intestine was much congested and contained fluid floccular grumous matter. Under the microscope the flakes were seen to consist of epithelial cells, and in the flakes, as also in the fluid parts of the material, large numbers of comma-shaped bacilli and S-shaped forms were found. Cultivations made in peptone salt solution yielded positive results in 12 hours; also distinct cholera red reaction. Subcultures made in the different media produced pure crops of Koch's comma-bacillus.

No. XLIV. Gloucester case.—Received from Dr. Campbell on October 5th a piece of ileum of C. W., *æt* 64. The ileum was much congested; in its cavity was a fluid brownish material. Under the microscope large flakes were seen to be made up entirely of epithelial cells, with numerous small bacilli (bacillus coli) in clumps and in streaks; no commas. Cultivations did not yield commas, but produced pure growths of bacillus coli.

No. XLV. North Bierley (case No. 1.)—Received on October 6th a piece of ileum of a youth (E. W., *æt.* 20), who had died after having been ill for 10 days from what was suspected to be cholera. The intestine was deeply congested; a Peyers patch and some solitary glands were deep purple. In the interior of the ileum there was no fluid, but a white slimy layer of brownish material adhered to its wall. Microscopic examination gave no definite result; but there were amongst a crowd of bacilli some that looked like commas. Cultivations gave negative results.

No. XLVa. North Bierley (case No. 2).—Received through Dr. Bulstrode on October 9th the rice-water stool of a woman, Mrs. L., the subject of supposed cholera. The stool presented all the essential characters of a cholera stool. It was a colourless fluid, in which were numerous large and small greyish-white flakes. These under the microscope were seen to consist of epithelial cells. Numerous commas, S-shaped bacteria, and free flagella were present in the fluid and in the flakes; the latter especially were crowded with them in clumps and in streaks. Cultivations yielded at once positive results; pure crops of Koch's commas were obtained in peptone salt solution, in gelatine plates, in broth peptone and on agar, by direct inoculation with the flakes diluted in salt solution. The cholera red reaction, too, was distinct in the peptone cultures.

No. XLVI. Dr. Reece handed to me on October 9th a stool of a case, Mrs. B., from Grimsby.—The stool was a brownish fluid. Microscopic examination and cultivations yielded negative results.

No. XLVII. On the same date, October 9th, Dr. Reece brought me from the fever hospital, Grimsby, a stool of another case (G. L.).—This stool was a brownish fluid, containing numerous epithelial flakes. There were present in the microscopic specimens numerous free flagella. Cultivations proved negative as to Koch's comma-bacillus.

No. XLVIII. Ormskirk case.—Received on October 9th a stool of a patient (P. K., *æt.* 33) sent by Dr. Hanly. The stool was of a brownish colour, semi-fluid in character, and of fœcal colour. Microscopic specimens showed amongst crowds of bacteria some few that looked like commas, and also a few free flagella. Cultivations, however, proved negative. (*See also No. L.*).

No. XLIX. Hartley Wintney (R.) case.—Received on October 10th stool of a case (B.). The stool was fluid, of a whitish-yellow colour. It contained crowds of bacteria, amongst them a few apparently comma-shaped. Cultivations proved negative.

No. L. Ormskirk case. (*See also No. XLVIII.*)—Received on October 11th a piece of ileum (tied at both ends) which had evidently been kept in spirit. It was congested. In its interior was brownish fluid matter, in which, under the microscope, epithelial flakes could be recognised; but nothing definite was observed as to the presence of comma-shaped bacilli. Cultivations were made in peptone salt solution, but the tubes of this medium remained sterile; no growth appeared in them. This result was evidently owing to the fact that the added spirit had killed the organisms present in the intestine.

No. LI. Balby (Doncaster, R.) case.—Received, on October 11th, a stool of a boy, H. L. The stool was of a typical rice-water

character. This slightly turbid colourless fluid showed numerous greyish white, large and small, epithelial flakes. Microscopic and cultural examination of these flakes proved this case to be true cholera. The material, in fact, next to Great Yarmouth case No. 2, was most characteristic of cholera: it afforded too Koch's comma-bacillus almost in pure culture. (*See* Fig. 8, Plate II.)

No. LII. Rawmarsh case.—Received on October 11th a piece of ileum of a person (M. A. M., *æt.* 42) supposed to have died from cholera. The intestine was congested, and contained rice water-like fluid. Microscopically this fluid was found to contain flakes which consisted of epithelial cells; and in these flakes were crowds of commas and S-shaped bacteria—in clumps and in streaks, almost in a pure culture. Cultivations in peptone salt solution, in gelatine plates, and on agar (made in each instance from a flake distributed in sterile salt solution), yielded pure cultures of Koch's commas. Cholera red reaction was distinct in these peptone cultures after only six hours' incubation.

No. LIII. Warrington case.—Received on October 17th a stool of a patient (T. J., *æt.* 30), and on October 18th a piece of intestine from the body of this person. The stool was a whitish colour, and contained but few flakes, not of epithelial character. There were present in its crowds of different bacteria, none of which could be recognised as commas, although there were present numerous free flagella. The intestine was deeply congested, and contained reddish thick mucoid matter; no definite comma-bacilli. Cultivations were made of the stool and of the intestinal contents, but they proved negative as regards comma-bacilli.

No. LIV. Bingley (Township) case.—Received on October 18th a bottle containing two or three greyish-looking mucus flakes and brownish fæcal masses derived from the bowels of a person who had died with suspicious symptoms. The microscopic examination showed numerous small epithelial masses, containing, amongst a crowd of various bacteria, some bacilli that looked like commas. Cultivations in peptone salt solution yielded at once crops of comma-bacilli, which in subcultures proved to be Koch's commas. Cholera red reaction distinct.

No. LV. Keighley case.—Received on October 26th, from Dr. Scatterly, a piece of ileum (tied at both ends) of Mrs. B. The intestine was much congested; it contained no fluid. The epithelium was only loosely adhering, and was easily detached. In microscopic specimens these detached masses were seen to contain numerous bacteria, but nothing definite as to comma-shaped bacilli. Cultivations were made in peptone salt solution, which, after 12 hours, yielded a crop of comma-bacilli. These, in subcultures in the various media, proved identical with Koch's commas; cholera red reaction distinct after 12 hours.

III.—Summary of Results.

In proceeding to summarise the facts that I have recorded it is ncessary to note, in the first place, that the 56 samples of material enumerated refer to 53 cholera cases, or quasi-cholera cases, only.*

* Nos. XLV. and XLV. (*a*) refer to separate cases; while Nos. XIX. and XXI., Nos. XXXI. and XLI., and Nos. XLVIII. and L. refer in each instance to a single case.

Secondly, it has to be noted that in 6 of the 53 cases which came under examination the material submitted had either been previously subjected to germicidal influences (Nos. VIII., XXXVII., XLII., and XLVIII. with L.), or had been obtained at so late a stage of the malady that was in question (Nos. XI. and XLV.) as to render negative evidence of a bacteriological sort of no particular value.* There remain, therefore, 47 cases to be accounted for.

Of the 47, in 30 (63·8 per cent.) positive evidence was forthcoming —by microscopic examination of the raw material, by cultural test of such material, or by both processes—that the cases in question were true cholera. In the remaining 17 (36·2 per cent.) the evidence was from the bacteriological view point generally of a negative character.

As to the nature of the evidence affirmative of cholera:—Of the 30 positive cases, in no less than 15 (Nos. I., II., III., IV., V., VI., XII., XIV., XXIV., XXVII., XXXVI., XL., XLV.(*a*), LI., and LII.) *the microscopic characters alone* of the material submitted to me—rice-water stool or contents of ileum—sufficed to establish bacterioscopically a diagnosis of true cholera.† In the other 15 of these 30 cases (Nos. IX., X., XIII., XV., XVII., XVIII., XXII., XXX., XXXIII., XXXVIII., XXXIX., XLI., XLIII., LIV., and LV.) *the culture tests* yielded positive results, notwithstanding that the microscopic appearances of the raw material had been equivocal or even negative.

IV.—Inferences.

With reference to the significance of the flakes present in the stools and in the intestinal contents, I would point out that in every one of the cases in which the cultures yielded positive evidence as to the presence of Koch's comma-bacillus, the stools or intestinal contents had showed flakes composed of epithelium which had become detached from the mucous membrane. It is true that out of 17 cases in which cultivation proved negative as regards comma-bacilli, there were flakes present in ten:—in four,‡ epithelial flakes; in six,§ flakes containing leucocytes only. But of the four containing epithelial flakes, no less than three were fatal; whereas all six cases in which the flakes contained only leucocytes recovered. Hence there can be no question that the presence of *epithelial* flakes in a stool derived from a patient suffering from symptoms indicative of choleraic disease is a very suspicious circumstance. Whether or not it be regarded as significant that the disease is Asiatic cholera, it is at least indicative that the prognosis respecting the case is a grave one.

As to the value for purposes of diagnosis of the demonstrated presence or absence of Koch's comma-bacilli in the stools or in the contents of the intestines, I must once more insist on the fact that in the present state of our knowledge the demonstration by culture of the

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* It is admitted by Koch and other observers that in cholera cases of three or four days' duration the comma-bacilli tend to disappear from the intestine, or at any rate cannot be demonstrated in culture.

† As regards no less than eight of the fifteen cases in question, the raw material submitted contained Koch's comma bacilli in abundance, and to the exclusion (or almost to the exclusion) of other micro-organisms.

‡ Nos. XXV., XXVIII., XLIV., and XLVII.

§ Nos. VII., XVI., XXIII., XXVI., XXXII., and XXXV.

presence of Koch's comma-bacillus is in the highest degree significant. As I have said, in no acute disease of the intestine in the human subject, except Asiatic cholera, is this species (answering to each of the various culture tests I have enumerated) known to occur. In papers that I wrote so long ago as 1886–87* I gave very definite expression to this view. I stated:† "One thing, however, may be said with "certainty, namely, that so far as our limited knowledge at present "goes, in no intestinal disorder in man (except true cholera) "have comma-bacilli behaving in artificial cultures like those of "Asiatic cholera been yet found in the intestinal evacuations." And again:‡ "Hence I agree with the proposition that if in any case "of diarrhœa the choleraic comma-bacilli can be shown both by the "microscope and by culture experiments to exist, then the suspicion "that it may be a case of Asiatic cholera is quite justified." It must be clear from this that if I still (1893) adhere to this proposition, I am not to be justly accused of having altered my former opinion. As previously, so also now, I fully endorse Koch and all who have had practical experience of cholera as to the diagnostic value of the cholera comma-bacilli.

A more important question is the diagnostic value in a negative sense of the absence of Koch's comma-bacillus in cases suspected to be Asiatic cholera. From facts within my own experience, some of them referred to in previous pages, I am inclined to agree with those observers who found that in localities and at times when cases of undoubted Asiatic cholera were present, there occur cases in which the history, symptoms, fatal issue, and pathology show them to be true cholera, notwithstanding that Koch's comma-bacillus cannot be demonstrated in the stools or in the intestinal contents by microscopic examination or by the culture tests.§ These facts appear to me now, as formerly, to conduce to hesitation in accepting Koch's comma-bacillus as the one essential factor in the causation of Asiatic cholera.

A further point of importance, to which attention was first directed by Dr. D. D. Cunningham, is the now admitted—though at first strenuously denied—fact that the cholera comma-bacilli isolated from different cases are not precisely the same. They differ from one another in some marked respects, so that at the very least they represent different varieties if not distinct species. This again is consistent with their being less directly related to the disease than has been accepted as proven.

Finally, as to the intraperitoneal virulence in guinea-pigs of the cultures of comma-bacilli from cholera cases. This, as I have shown, does not necessarily support the view that the comma-bacilli are the cause of Asiatic cholera; for in the first place the disease thus produced in the guinea-pig is acute peritonitis and not cholera, and in the second place a variety of other microbes injected in the same manner into the

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* Reprinted in book form, and entitled "The Bacteria in Asiatic Cholera," Macmillan & Co.

† *l.c.*, page 114.

‡ *l.c.*, page 115.

§ In Hamburg (Hueppe) in August and September 1892; in Russia 1892 (Nencki and his pupils); in Paris 1892 (Peter and others); not to go back to the epidemic of cholera in Spain in 1886 (Roy, Brown, and Sherrington). Professor Virchow, too, on his return from a visit to Russia (autumn 1892) distinctly warns against the Berlin method as to describing as cholera nostras, cases in which the comma-bacilli are not found.

guinea-pig produce clinically the same disease, with identical pathological appearances. These points, however, I have fully discussed in my Report on "Antagonisms of Microbes" for 1892–93.*

I append a tabular statement with regard to the microscopic and bacteriological examination of the 30 positive cases.

App. B. No. 17.

Observations on reputed Cholera Material submitted for examination; by Dr. Klein, F.R.S.

* Report of the Medical Officer of the Local Government Board, 1892–93, pp. 367–389.

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Observations on reputed Cholera Material submitted for examination: by Dr. Klein, F.R.S.

Tabular Statement of the Results of Examination of

No.	A. Derivation of Material.	B. Microscopical Characters of Stool or of Intestinal Contents.	C. General Characters of Cultures.	D. Cholera Red Reaction.
I.	Hull, No. 1	Typical	Positive	Distinct
II.	Grimsby, No. 1	"	"	"
III.	Grimsby, No. 2	"	"	"
IV.	Hull, No. 2	"	"	"
V.	Rotherham	"	"	"
VI.	Westminster	"	"	"
IX.	Boston	Not altogether typical.	"	"
X.	Morton (Gainsboro' R.)	" " "	"	"
XII.	Leicester	Typical	"	"
XIII.	Handsworth	Doubtful	"	"
XIV.	Retford	Typical	"	"
XV.	Fulham	Not typical	"	"
XVII.	Kennington (Lambeth)	"	"	"
XVIII.	Ashbourne	"	"	"
XXII.	Croydon Borough	"	"	"
XXIV.	Derby	Typical	"	"
XXVII.	Accrington	"	"	"
XXX.	Ilkeston	Not typical	"	"
XXXIII.	Appleton-le-Street, No. 1	Fairly typical	"	"
XXXVI.	Great Yarmouth, No. 1	Typical	"	"
XXXVIII.	Tividale (Rowley Regis)	Fairly typical	"	"
XXXIX.	Southwark (St. George-the Martyr).	Not typical	Not liquefying gelatine in stab, slowly liquefying in plate culture.	"
XL.	Great Yarmouth, No. 2	Typical	Positive	"
XLI.	Liverpool	Not typical	"	"
XLIII.	Coton Hill (Stafford R.)	Fairly typical	"	"
XLV(a).	North Bierley, No. 2	Typical	"	"
LI.	Balby (Doncaster R.)	"	"	"
LII.	Rawmarsh	"	"	"
LIV.	Bingley (Township)	Not typical	"	"
LV.	Keighley	Doubtful	"	"

Material, obtained from the 30 positive Cases.

E. Growth in Gelatine Stab Culture	F. Growth in Potato Culture at 37° C.	G. Milk Culture at 37° C.	H. Amount of Agar Culture required for production, by Intra-peritoneal Injection, of Fatal Result in Guinea-pigs.
Liquefied fairly quick; good pellicle.	No growth after 10-14 days.	Coagulated after 11 days	$\frac{1}{6}$ of a tube.
" " "	Light yellow after 14 days	Fluid after 14 "	$\frac{1}{5}$ "
Liquefies quickly; no pellicle	No growth after 14 "	Coagulated after 6 "	$\frac{1}{6}$, $\frac{1}{4}$ "
" " "	" 14 "	" 11 "	$\frac{1}{5}$ "
" " slight pellicle	" 14 "	Fluid after 14 "	Not tested.
" " "	" 14 "	" 14 "	$\frac{1}{5}$ of a tube.
Fairly quick; good pellicle -	" 14 "	" 14 "	Not tested.
" no pellicle -	Light yellow after 14 "	Coagulated after 5 "	"
Moderate; good pellicle -	" brown after 5 "	" 5 "	$\frac{1}{5}$ of a tube.
Fairly quick; slight pellicle -	No growth after 14 "	Fluid after 14 "	Not tested.
Moderate; slight pellicle -	" 14 "	Coagulated after 5 "	"
Fairly quick; good pellicle -	" 14 "	Fluid after 14 "	$\frac{1}{6}$, $\frac{1}{4}$ of a tube.
Quick; slight pellicle -	" 14 "	Coagulated after 6 "	$\frac{1}{6}$, $\frac{1}{4}$ "
Slow; no pellicle - -	" 14 "	" 10 "	$\frac{1}{6}$, $\frac{1}{4}$ "
Quick; good pellicle - -	" 14 "	" 6 "	Not tested.
" no pellicle - -	" 14 "	Fluid after 14 "	$\frac{1}{5}$ of a tube.
Slow; good pellicle - -	Light yellow after 5 "	" 14 "	$\frac{1}{6}$ "
" " - -	" 5 "	" 14 "	Not tested.
Fairly quick; good pellicle -	No growth after 14 "	Coagulated after 10 "	"
" " " -	" 14 "	" 11 "	$\frac{1}{6}$ of a tube.
Slow; no pellicle - -	" 14 "	" 5 "	Not tested.
Not liquefying - -	" 14 "	Fluid after 14 "	$\frac{1}{6}$ of a tube.
Quick; slight pellicle -	" 14 "	Coagulated after 11 "	$\frac{1}{6}$, $\frac{1}{6}$ "
Fairly quick; good pellicle -	" 14 "	" 5 "	Not tested.
Moderate; good pellicle -	Light yellow after 5 "	" 10 "	$\frac{1}{6}$ of a tube.
Quick; no pellicle - -	No growth after 14 "	" 14 "	Not tested.
" slight pellicle - -	" 14 "	" 5 "	"
" good pellicle - -	" 14 "	" 5	"
Very quick; no pellicle -	" 14 "	" 6 "	"
" " - -	Light yellow after 14 "	" 6 "	$\frac{1}{6}$, $\frac{1}{4}$ of a tube.

App. B. No. 17.

Observations on reputed Cholera Material submitted for examination; by Dr. Klein, F.R.S.

Report on Samples of Water derived from Localities in which cases of Cholera had been occurring; by Dr. Klein, F.R.S.

A. Water from Sutton Dyke at Hull.

On September 1st Dr. Theodore Thomson brought to me two bottles of water derived from the "Sutton Dyke" at Hull. This water was turbid owing to the presence of numerous brownish particles and greyish translucent flocculi. Coverglass specimens were made from the water, after shaking it up, in the following manner. Two to five drops were deposited in the middle of a coverglass and rapidly dried over the flame; then stained, washed, and mounted. In this way all the organisms present in the above quantity were brought to view within a comparatively small area. As far as shape is concerned there could be made out amongst the very considerable number of bacteria present the following forms:—

(*a*) Cocci, singly or in dumb-bells (diplococci);
(*b*) Cylindrical rods of various length, thin;
(*c*) Cylindrical rods of various length, thick;
(*d*) Short oval bacteria; and
(*e*) distinctly comma-shaped forms.

The latter were in some places very abundant, forming small groups, and between the groups were isolated commas. In size the commas were not unlike those of cholera.

Cultivations were next made:—(*a*) in peptone salt solution; and (*b*) in gelatine plates. For each tube and each plate 1 to 5 drops of the water were used. The peptone tubes were incubated at 37° C., the gelatine plates at 20° C.

After 24 hours incubation there was turbidity in the peptone tubes. Taking therefrom, out of the superficial layer at this stage, a small droplet, making therewith a cover-glass film preparation, and staining and mounting it, numerous commas and S-shaped forms were seen, as well as some straight cylindrical bacilli both thick and thin. The comma-bacilli in some regions of the cover-glass specimen seemed almost in pure culture.

From the same peptone tube a droplet was taken, and placed, for the sake of dilution, in about 10 cc. of sterile salt solution, and of this mixture traces were deposited by a platinum needle in fresh peptone tubes, and in gelatine for plate cultivation. In the secondary set of peptone tubes, after 24 hours' incubation, an almost pure cultivation of the above commas was obtained; likewise in the secondary gelatine plates. As regards motility, size, and the S-shaped and spiral forms, no difference could be seen between the comma-bacilli (*see* Fig. 19, Plate V.), thus obtained from the Sutton Dyke water, and those obtained from cholera cases. But on studying more carefully in cultivation this "Hull water comma-bacillus," the following differences could be established:—

(1.) The Hull water commas grew very much more rapidly in gelatine than Koch's cholera commas. In Figs. 1, 2, 3, 4, and 5, Plate XIII., gelatine stab cultivations are shown after 24, 48, and 96 hours incubation at 20° C. It will be noticed that the rapidity of growth of, and liquefaction by, this bacillus is very great, greater even than that of Finkler's comma-bacillus; there is formed, in four days, on the surface of the liquefied gelatine a distinct pellicle.

(2.) In gelatine plate cultivation, although the general character of the colonies (liquefying character, central whitish granular deposit), is similar to that of Koch's commas, the rapidity of liquefaction by the

growth is very much greater. Further, in connexion with many of the colonies appearing in the gelatine plate, there is present a distinct gas bubble, which enlarges with the enlargement of the colony. (*See* Figs. 1, 2, and 3, Plate XVII.).

(3.) In peptone salt cultivations incubated at 37° C., the turbidity and growth is not by any means so copious and rapid with the Hull water comma as with Koch's cholera comma; besides the turbidity produced by the latter is uniform, whereas that produced by the Hull water comma is not. After some days, the Hull water comma forms greater turbidity in the top layers than in the depth; in the latter situation it is only evident in the form of small granules. It grows faster in peptone at 20° C. than at 37° C.

(4.) On agar at 37° C. no difference is to be observed.

(5.) On potato and in milk. On potato kept at 20° C., the growth assumes after two to three days incubation a light but distinct yellow brown tint; at 37° C. a colourless thinner film. Milk at 20° C. is coagulated after 48 hours; incubated for equal time at 37° C. the milk is fluid, but in an additional day is also coagulated.

With regard to the cholera red reaction, peptone cultures at 20° C. after 48 hours (there being then a fair amount of growth) give a faint rose colour on addition of sulphuric acid. But the tint is less deep than in peptone cultures of Koch's commas.

Agar cultures of the Hull water bacillus were used for intraperitoneal injection of guinea-pigs, $\frac{1}{2}$ and $\frac{1}{4}$ the scrapings of a tube being used for different animals. Both were dead next morning with intense peritonitis, and the copious peritoneal fluid was crowded with the comma-bacillus that had been injected.

On the whole then the Hull water comma-bacillus is not, in view of these facts, to be accepted as culturally identical with Koch's cholera comma-bacillus. On the other hand, it is impossible to deny that these Hull vibrios and Koch commas may be samples of the same organism in different phases. The Hull water comma-bacillus may be, for all we know to the contrary, Koch's bacillus modified by existence for a considerable space of time outside the animal body.

Sanarelli* believes that certain comma-bacilli found by him in Seine water and elsewhere, and which differed in some points from Koch's cholera vibrio, had nevertheless been derived from cholera dejecta voided during the previous year. He considers that Koch's comma-bacillus having lived for a length of time an abnormal existence—to wit, in water—may have degenerated, and have become altered in some of its cultural characters. But of course this is mere surmise; as yet it is neither proved nor disproved. As far as the facts go in this particular instance, it is only safe to say that differences do certainly exist between the Koch's comma-bacillus and the Hull Dyke water comma similar in kind to those existing between Koch's cholera comma and Sanarelli's water comma.

From the Hull Dyke water, besides the comma-bacillus above mentioned, I isolated the following species of bacteria: (*a*) bacillus fluorescens liquescens; (*b*) proteus vulgaris (*c*) bacillus coli; (*d*) various species of cocci.

B.—*Water taken from a Well at Ashbourne believed to have been concerned in Dissemination of Cholera.*

This water was received on September 15th. It was turbid and contained brownish sediment. On shaking, numerous flocculi appeared suspended in it.

* Annales de l'Institut Pasteur, November 1893.

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Observations on reputed Cholera Material submitted for examination; by Dr. Klein, F.R.S.

Coverglass specimens made in the manner above described--3-5 drops allowed to dry on the centre of a coverglass—showed a considerable number of distinct commas and S-shaped forms, besides cocci and oval and cylindrical bacilli of different thickness. Cultures made in peptone salt solution, by addition to each tube of one drop of this water, yielded in 24 hours, in their superficial layers, a crop of comma bacilli which, on subcultures in peptone salt solution and in gelatine plates, proved to be Koch's comma-bacillus in pure culture. These subcultures responded indeed to all those tests which characterise the cholera-bacillus, and which have been fully described and illustrated in the preceding pages. Here it will be enough to note that in the original peptone cultures the comma-bacilli isolated from the Ashbourne water were morphologically and culturally (with inclusion of distinct cholera red reaction) identical with those obtained from the contents of the intestine of cholera patients.

By gelatine plate culture, bacillus coli, bacillus fluorescens liquescens, and proteus vulgaris were also isolated from this Ashbourne water.

C.—*Well Water from Appleton-le-Street (Malton R.).*

Examination of this water did not yield positive results. Large numbers of cultivations were made in peptone salt solution and in gelatine plates, but no comma-bacilli were obtained.

D.—*Well Water taken from Tap in Nottingham Road, Borough of Ilkeston.*

Here also cultivations in peptone salt solution, and in gelatine plates failed to yield any micro-organisms in shape and character resembling comma-bacilli.

I append in tabular form the results of my examination of water samples from the Sutton Dyke, at Hull, and from the Ashbourne well :—

Derivation of Sample.	General Result of Culture.	Growth in Gelatine Stab Culture.	Growth in Potato Culture.	Milk at 37° C.	Amount of Agar Culture required for production, by Intra-peritoneal Injection, of Fatal Result in Guinea-pigs.
Hull (Sutton Dyke).	Grows best at 20° C.	Very quick; good pellicle.	Light brown at 20° C.	Coagulated in 2-3 days.	¼ of a tube.
Ashbourne well	Positive in all media.	Slow; no pellicle.	No growth at 37° C.	Fluid after 14 days.	¼ "

Fig. 1.

Fig 2.

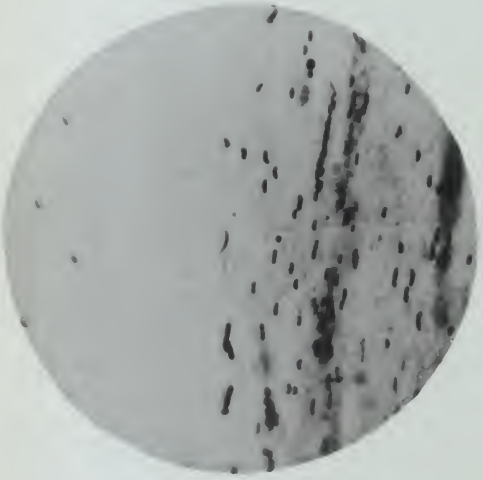

Fig. 3.

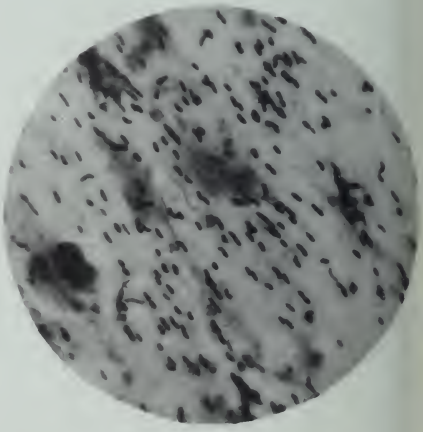

Fig. 4.

BACTERIOLOGY OF CHOLERA.

PLATE I.

Fig. 1.

Reproduced from a photograph* of a cover-glass specimen of an epithelial flake derived from a *rice-water stool* of the Westminster case (No. VI.). A large number of typical *comma-bacilli* are here seen. Also a number of *flagella*; some free, some still attached to the vibrios.

Fig. 2.

A similar specimen from the same source, showing the *comma-bacilli* almost in pure culture; also flagella.

Fig. 3.

Another specimen from the same source, showing the characteristic "fish-in-stream" arrangement of the vibrios, one of which is seen to possess a flagellum.

Fig. 4.

Reproduced from a photograph of a cover-glass specimen of an epithelial flake from the *intestinal contents* of the Westminster case. The *comma-bacilli* are here seen in pure culture, and distributed in characteristic fashion.

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* The photographs for this Volume were taken by Mr. E. C. Bousfield. Unless otherwise stated, the magnifying power is 1,000.
The "reproductions" of the photographs are by the Autotype Company.

BACTERIOLOGY OF CHOLERA.

PLATE II.

FIG. 5.

Reproduced from a photograph of a cover-glass specimen of the *contents of the intestine* of the Fulham case (No. XV.). Amongst the numerous bacteria present in the specimen, some are seen to be comma-shaped; and there are also numerous flagella.

FIG. 6.

Reproduced from a photograph of a cover-glass specimen of the *contents of the intestine* of a Yarmouth case (No. XXXVI.). The *comma-bacilli* appear here in pure culture.

FIG. 7.

Reproduced from a photograph of a cover-glass specimen of an epithelial flake from the *rice-water stool* of a Yarmouth case (No. XL.). Here again the *comma-bacilli* appear in pure culture.

FIG. 8.

Reproduced from a photograph of a cover-glass specimen from the *stool* of the Balby case (No. LI.). The *comma-bacilli* appear in pure culture. Also there are seen numerous flagella; some free, some attached still to the vibrios.

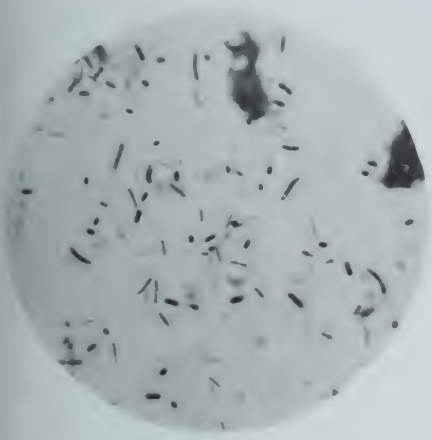

Fig. 5.

Fig. 6.

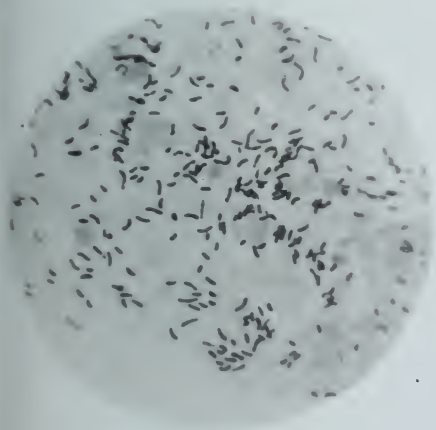

Fig. 7.

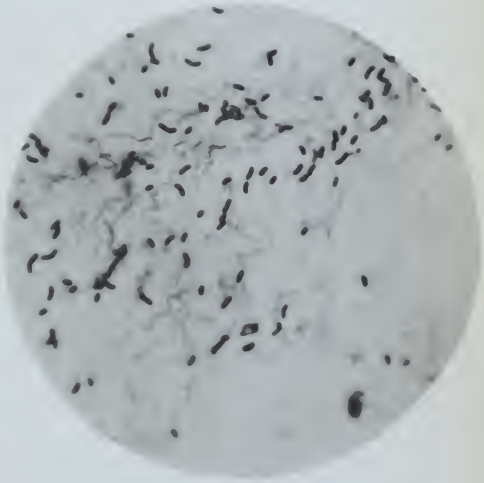

Fig. 8.

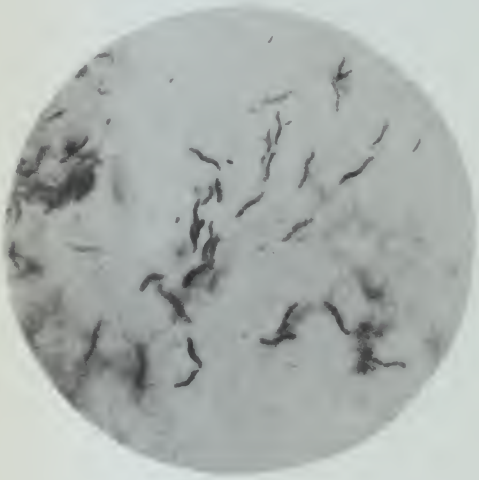

Fig. 9.

Fig. 10.

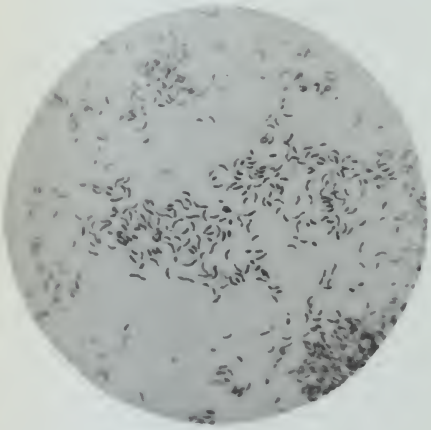

Fig. 11.

Fig. 12.

BACTERIOLOGY OF CHOLERA.

PLATE III.

Fig. 9.

Reproduced from a photograph of a cover-glass specimen from the *stool* of the Balby case (No. LI.). There is here exhibited another form of vibrio than that shown in Fig. 8 (Plate II.). It is much larger, for instance, as well as spirillum-like; flagella are also seen.

Fig. 10.

Reproduced from a photograph of a cover-glass specimen of an *epithelial flake* derived from an Appleton-le-Street case (No. XXXIII.). The specimen is typical of cholera; the *comma-bacilli* appearing in pure culture and distributed in the characteristic "fish-in-stream" arrangement.

Fig. 11.

Reproduced from a photograph of a cover-glass specimen from an *agar culture* of the vibrio of the above Appleton-le-Street case (No. XXXIII.).

Fig. 12.

Reproduced from a photograph of a cover-glass specimen from the *contents of the intestine* of the Rotherham case (No. V.). The *comma-bacilli*, though not numerous, were in pure culture in this specimen.

BACTERIOLOGY OF CHOLERA.

PLATE IV.

Fig. 13.

Reproduced from a photograph of a cover-glass specimen of an *epithelial flake* from the Rawmarsh case (No. LII.). The *comma-bacilli* are in pure culture, and exhibit the characteristic "fish-in-stream" arrangement.

Fig. 14.

Reproduced from a photograph of a cover-glass specimen from the *intestinal contents* of the Liverpool case (No. XLI.). Numerous flagella are here seen.

Fig. 15.

Reproduced from a photograph of a cover-glass specimen of the pellicle of a *broth culture* derived from the Retford case (No. XIV.). Spirilla-like forms, unsegmented, are here seen.

Fig. 16.

Reproduced from a photograph of a cover-glass specimen of the pellicle of a *broth culture* derived from the 2nd Yarmouth case (No. XL.). Here again spirilla-like forms are seen, but they are distinctly segmented.

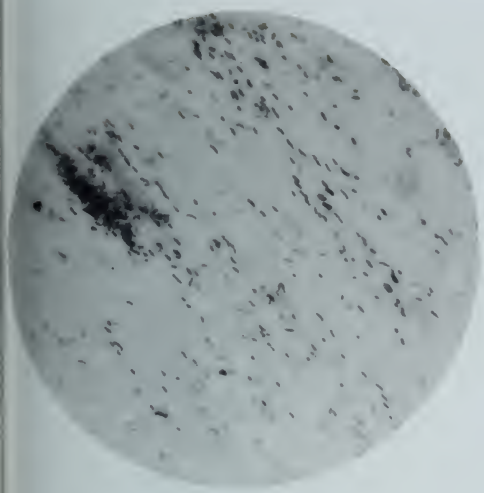

Fig. 13.

Fig. 14.

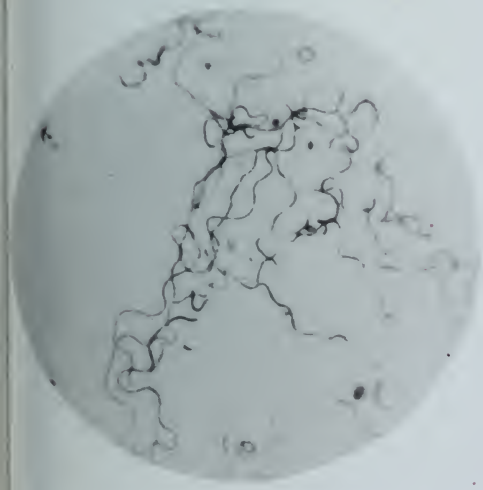

Fig. 15.

Fig. 16.

FIG. 17.

FIG. 18.

FIG. 19.

FIG. 20.

BACTERIOLOGY OF CHOLERA.

PLATE V.

FIG. 17.

Reproduced from a photograph of a cover-glass specimen of a *flocculus* from the water of the *Ashbourne well.* Abundance of comma-bacilli are here seen.

FIG. 18.

Sample from a *culture in peptone salt solution* of the comma-bacillus derived from the water of the Ashbourne well.

FIG. 19.

Reproduced from a photograph of a cover-glass specimen of *comma-bacilli* from a culture *in peptone salt solution,* derived from the water of Sutton Dyke, Hull.

FIG. 20.

Reproduced from a photograph of a cover-glass specimen from a *stool* of a person attacked by diarrhœal illness in Greenwich Union Workhouse. Threads of *cylindrical bacilli* are here seen.

BACTERIOLOGY OF CHOLERA.

PLATE VI.

Fig. 21.

Reproduced from a photograph of a cover-glass specimen of *culture* in *peptone salt solution* of material from a stool, referred to under Fig. 20, as voided by one of the Greenwich Workhouse cases. The bacilli here seen are identical with those depicted in Fig. 20, Plate V.; their bipolar staining was well marked.

Fig. 22.

Sample of bacilli of similar description from a culture derived from another Greenwich Workhouse case.

Fig. 22 (a).

Specimen of a section through the *kidney* of one of the Greenwich Workhouse cases; showing clumps of the above bacilli.

Fig. 23.

Reproduced from a photograph of a cover-glass specimen from a culture in *peptone salt solution* of *comma-bacilli* from the water of the Greenwich Workhouse well.

Fig. 24.

Section* through the mucous membrane of the *ileum* of the Southwark case (No. XXXIX.). It shows masses of detached epithelium from a Lieberkühn follicle, with numerous *comma-bacilli* between the masses.

Fig. 25.

The same specimen under the higher magnifying power.

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* Magnifying power 650.

Fig. 21.

Fig. 22.

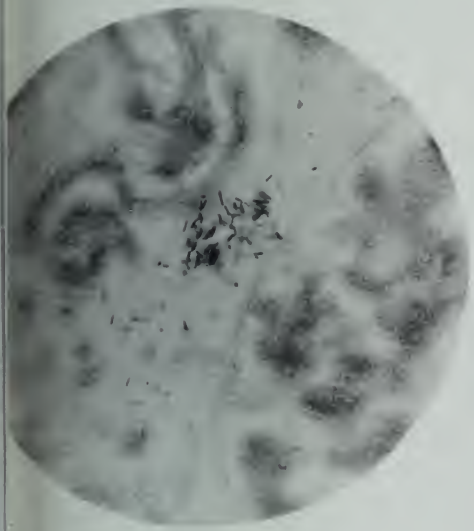


Fig. 22*a*.

Fig. 23.

Fig. 24.

Fig. 25.

Hull I.
after 8 days

1

Grimsby I.
after 8 days

2

Grimsby II.
after 8 days

3

Hull II.
after 8 days

4

Rotherham
after 8 days

5.

Westminster
after 7 days

6.

Boston
after 7 days

7.

Gainsboro
after 7 days

8.

BACTERIOLOGY OF CHOLERA.

PLATE VII.

[NOTE.—The drawings in this and in succeeding plates (up to and inclusive of Plate XII.) represent *stab-cultures* in gelatine of the comma-bacilli obtained from different samples of cholera material examined by me in 1893. These drawings enable comparison to be made, as regards rapidity of growth and liquefaction of the gelatine, between comma-bacilli from the different sources. The gelatine medium used was in every instance of precisely the same composition, and in all the subcultures depicted the contained comma-bacilli were an equal number of removes from the raw material whence they were derived. The gelatine medium was inoculated in each instance by a single stab, and all the subcultures were incubated at 20° C.—E.K.]

Fig. 1. Hull (1); No. I. in the text of this report.
Fig. 2. Grimsby (1); No. II. ,, ,,
Fig. 3. Grimsby (2); No. III. ,, ,,
Fig. 4. Hull (2); No. IV. ,, ,,
Fig. 5. Rotherham; No. V. ,, ,,
Fig. 6. Westminster; No. VI. ,, ,,
Fig. 7. Boston; No. IX. ,, ,,
Fig. 8. Morton (Gainsborough Rural); No. X. in the text of this report.

Rotherham and Grimsby (2) afford instances of comma-bacilli rapidly liquefying the gelatine. In the case of Morton (Gainsborough Rural), the process is observed to be much more slow.

BACTERIOLOGY OF CHOLERA.

PLATE VIII.

[NOTE.—The drawings in this, as in other plates, VII. to XII. inclusive, represent *stab-cultures* in gelatine of the comma-bacilli obtained from different samples of cholera material examined by me in 1893. These drawings enable comparison to be made, as regards rapidity of growth and liquefaction of the gelatine, between comma-bacilli from the different sources. The gelatine medium used was in every instance of precisely the same composition, and in all the subcultures depicted the contained comma-bacilli were an equal number of removes from the raw material whence they were derived. The gelatine medium was inoculated in each instance by a single stab, and all the subcultures were incubated at 20° C.—E.K.]

Fig. 8 (A). Morton (Gainsborough R.);	No. X. in the text of this report.	
Figs. 9 and 9 (A). Leicester;	No. XII.	,, ,,
Fig. 10. Handsworth (Yorks);	No. XIII.	,, ,,
Figs. 11 and 11 (A). Retford;	No. XIV.	,, ,,
Fig. 12. Fulham;	No. XV.	,, ,,
Fig. 13. Kennington (Lambeth);	No. XVII.	,, ,,

Handsworth and Fulham afford the most rapidly liquefying comma-bacilli of this series.

8 a.

9.

9 a

10

11.

11 a.

12.

13.

14.

14 a

15

15 a

16.

16 a.

17.

17 a

BACTERIOLOGY OF CHOLERA.

PLATE IX.

[NOTE.—The drawings in this, as in other plates, VII. to XII. inclusive, represent *stab-cultures* in gelatine of the comma-bacilli obtained from different samples of cholera material examined by me in 1893. These drawings enable comparison to be made, as regards rapidity of growth and liquefaction of the gelatine, between comma-bacilli from the different sources. The gelatine medium used was in every instance of precisely the same composition, and in all the subcultures depicted the contained comma-bacilli were an equal number of removes from the raw material whence they were derived. The gelatine medium was inoculated in each instance by a single stab, and all the subcultures were incubated at 20° C.—E.K.]

Figs. 14 and 14 (A), Ashbourne; No. XVIII. in the text of this report.
Figs. 15 and 15 (A), Croydon; No. XXII. ,, ,, ,,
Figs. 16 and 16 (A), Derby; No. XXIV. ,, ,, ,,
Figs. 17 and 17 (A), Accrington; No. XXVII. ,, ,, ,,

Croydon and Derby afford instances of rapidly liquefying comma-bacilli, and in this sense are in contrast with Accrington and Ashbourne.

BACTERIOLOGY OF CHOLERA.

PLATE X.

[NOTE.—The drawings in this, as in other plates, VII. to XII. inclusive, represent *stab-cultures* in gelatine of the comma-bacilli obtained from different samples of cholera material examined by me in 1893. These drawings enable comparison to be made, as regards rapidity of growth and liquefaction of the gelatine, between comma-bacilli from the different sources. The gelatine medium used was in every instance of precisely the same composition, and in all the subcultures depicted the contained comma-bacilli were an equal number of removes from the raw material whence they were derived. The gelatine medium was inoculated in each instance by a single stab, and all the subcultures were incubated at 20° C.—E.K.]

Figs. 18 and 18 (A), Ilkeston; No. XXX. in the text of this report.

Figs. 19 and 19 (A), Appleton-le-Street (1) (Malton Rural); No. XXXIII. in the text of this report.

Fig. 20, Great Yarmouth (1); No. XXXVI. in the text of this report.

Figs. 21 and 21 (A), Tividale (Rowley Regis); No. XXXVIII. in the text of this report.

Fig. 22, Southwark (St. George the Martyr); No. XXXIX. in the text of this report.

Southwark is an example of comma-bacilli that are practically non-liquefying: and Ilkeston and Tividale (Rowley Regis) represent comma-bacilli that liquefy the gelatine only slowly.

18.

18 a.

19.

19 a.

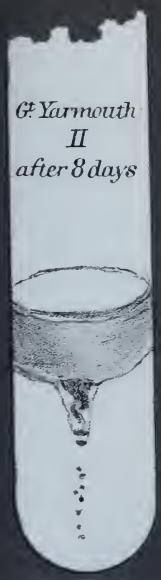
20

21.

21 a.

22.

5538 4.94.



23.

24.

24a.

25.

25a.

26.

5538 4. 94

BACTERIOLOGY OF CHOLERA.

PLATE XI.

[NOTE.—The drawings in this, as in other plates, VII. to XII. inclusive, represent *stab-cultures* in gelatine of the comma-bacilli obtained from different samples of cholera material examined by me in 1893. These drawings enable comparison to be made, as regards rapidity of growth and liquefaction of the gelatine, between comma bacilli from the different sources. The gelatine medium used was in every instance of precisely the same composition, and in all the subcultures depicted the contained comma-bacilli were an equal number of removes from the raw material whence they were derived. The gelatine medium was inoculated in each instance by a single stab, and all the subcultures were incubated at 20° C.—E.K.]

Fig. 23, Great Yarmouth (2); No. XL. in the text of this report.

Figs. 24 and 24 (A), Liverpool; No. XLI. ,, ,,

Figs. 25 and 25 (A), Coton Hill (Stafford Rural); No. XLIII. in the text of this report.

Fig. 26, North Bierley (2); No. XLV. (A) in the text of this report.

Great Yarmouth (2) affords an instance of comma-bacilli rapidly liquefying gelatine; Coton Hill of comma-bacilli accomplishing this more slowly.

BACTERIOLOGY OF CHOLERA.

PLATE XII.

[NOTE.—The drawings in this, as in other plates, VII. to XII. inclusive, represent *stab-cultures* in gelatine of the comma-bacilli obtained from different samples of cholera material examined by me in 1893. These drawings enable comparison to be made, as regards rapidity of growth and liquefaction of the gelatine, between comma-bacilli from the different sources. The gelatine medium used was in every instance of precisely the same composition, and in all the subcultures depicted the contained comma-bacilli were an equal number of removes from the raw material whence they were derived. The gelatine medium was inoculated in each instance by a single stab, and all the subcultures were incubated at 20° C.—E.K.]

Fig. 26 (A), North Bierley (2); No. XLV. (A) in the text of this report.

Figs. 27 and 27 (A), Balby (Doncaster Rural); No. LI. in the text of this report.

Fig. 28, Rawmarsh; No. LII. in the text of this report.

Fig. 29, Bingley (Township); No. LIV. in the text of this report.

Fig. 30, Keighley; No. LV. in the text of this report.

Bingley and Keighley afford instances of comma-bacilli liquefying the gelatine with great rapidity.

26a.

27.

27a

28.

29

30

5538. 4 54

1.

2.

3

4.

5.

1 a.

2 a.

3 a.

BACTERIOLOGY OF CHOLERA.

PLATE XIII.

Stab-cultures in gelatine of comma-bacilli from the water of Sutton Dyke, Hull.

Figs. 1 and 2, after incubation at 20° C. for 24 hours.
Figs. 3 and 4, ,, ,, 48 hours.
Fig. 5, ,, ,, 4 days.

Cholera-red reaction produced, after incubation at 37° C., in subcultures in peptone salt solution of comma-bacilli, by addition of pure sulphuric acid.

Fig. 1 (A). Acid added, to subculture in a solution containing 1 per cent. peptone, after incubation for 24 hours.

Fig. 2 (A). Acid added, to subculture in a solution containing 1 per cent. peptone, after incubation for 48 hours.

Fig. 3 (A). Acid added, to subculture in a solution containing 2 per cent. peptone, after incubation for 48 hours.

BACTERIOLOGY OF CHOLERA.

PLATE XIV.

Colonies in *gelatine-plate culture* of the comma-bacilli derived from different cholera cases ; after incubation at 20° C.

[The colonies are represented twice their natural size.]

Figs. 1, 2, and 3, Grimsby (2) ; No. III. in the text of this report.
Figs. 4 and 5, Westminster ; No. VI. in the text of this report.
Fig. 6, Ashbourne ; No. XVII. in the text of this report.

1.
Grimsby II. 6 days.

2. 3.
Grimsby II 8 days.

Westminster 4 days.

Ashbourne 6 days

4. 5. 6.

5538 4 94

7.

8.
Fulham 6 days

9.
Accrington, 6 days.

10
Southwark. 9 days.

5538.4.34

BACTERIOLOGY OF CHOLERA.

PLATE XV.

Colonies in *gelatine-plate culture* of comma-bacilli derived from different cholera cases; after incubation at 20° C.

[The colonies are represented twice their natural size.]

Figs. 7 and 8, Fulham; No. XV. in the text of this report.

Fig. 9, Accrington; No. XXVII. in the text of this report.

Fig. 10, Southwark (St. George the Martyr); No. XXXIX. in the text of this report.

BACTERIOLOGY OF CHOLERA.

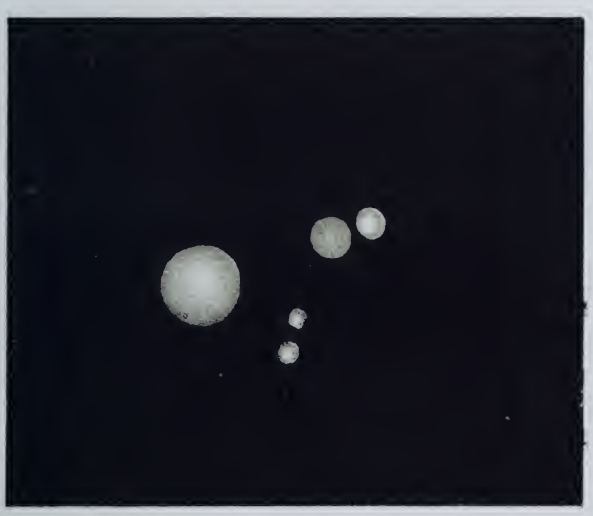
PLATE XVI.

Colonies on *the surface of agar plates* of comma-bacilli derived from different cholera cases; after incubation at 37° C.

[The colonies are represented twice their natural size.]

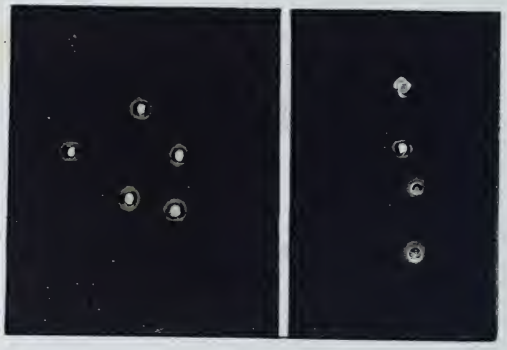
Fig. 1, Grimsby (2); No. IV. in the text of this report.
Fig. 2, Westminster; No. VI. ,, ,,
Fig. 3, Southwark (St. George the Martyr); No. XXXIX. in the text of this report.

3.
Southwark Agar 24 Hours.

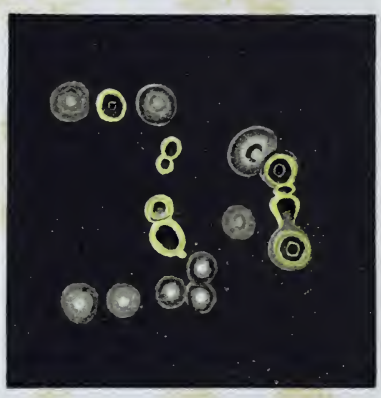


2.
Westminster, 24 Hours Agar

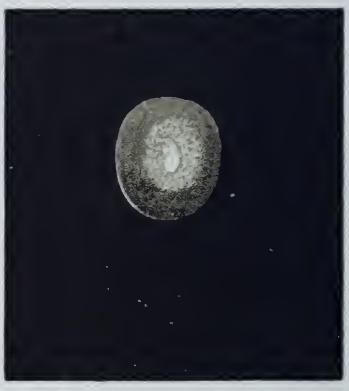
1.
Grimsby II. 24 Hours Agar.



1. 2.
Hull Water 24 Hours



3
Hull Water 48 Hours



4
Comma bacillus Greenwich water 2 days

5538 4.94

BACTERIOLOGY OF CHOLERA.

PLATE XVII.

Colonies *in gelatine plate culture* of comma-bacilli from the Sutton Dyke Water, Hull, and from the water of the Greenwich Workhouse well; incubated at 20° C.

Figs. 1, 2, and 3, Sutton Dyke Water, Hull; pages 192–93 of this report.
Fig. 4, Greenwich Workhouse well; page 235 ,,

BACTERIOLOGY OF CHOLERA.

PLATE XVIII.

Figs. 5 and 6, Colonies of proteus vulgaris, derived from the water of the Greenwich Workhouse well, liquefying the gelatine medium in which they are growing; after incubation at 20° C.

Fig. 7. Colonies of a proteus-like organism, derived from the intestinal contents of one of the Greenwich Workhouse diarrhœa cases, liquefying the gelatine in which they are growing; after incubation at 20° C.

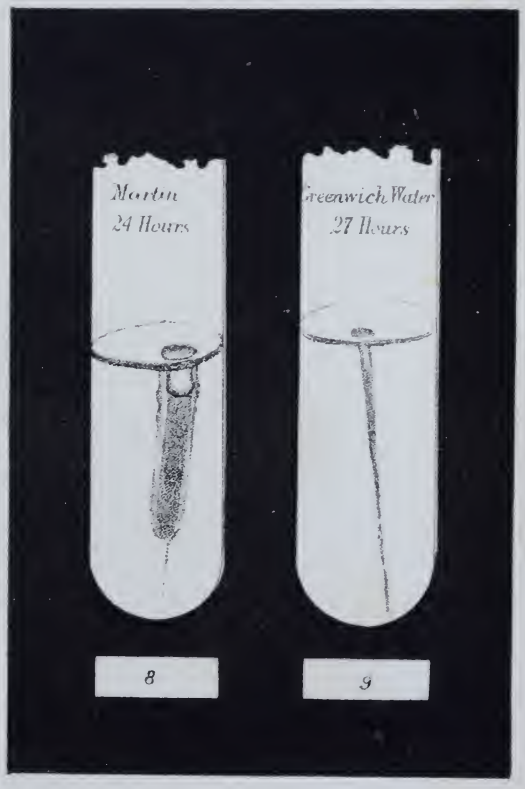
Fig. 8. A *stab-culture* in gelatine of the proteus-like organism from a Greenwich Workhouse diarrhœa case; after incubation at 20° C.

Fig. 9. A *stab-culture* in gelatine of proteus vulgaris from the water of the Greenwich Workhouse well; after incubation at 20° C.

5.
Greenwich Water after 36 Hours.

6.
Greenwich Water after 48 Hours.

7.
Martin Greenwich 36 Hours.



5538 4 94

APPENDIX C.

Report on an Outbreak of Illness characterized by Diarrhœa, Vomiting, and Cramps, which occurred at the Greenwich Union Workhouse, Maze Hill, in October 1893; by Dr. H. Timbrell Bulstrode.

On Thursday, October 12th, 1893, a communication was received from Mr. Braxton Hicks, Coroner for the South-Western District of London, informing the Board that the body of a woman, named Harriett C., was awaiting inquest at the Lambeth Mortuary. It appeared that C. had died while out on leave from Greenwich Workhouse, after a violent attack of diarrhœa and vomiting.

Mr. Braxton Hicks also mentioned, as a matter incidentally reported to him, that there had been numerous cases of a similar nature at Greenwich Workhouse, and that three deaths had already resulted. Upon inquiry the same day at Greenwich Workhouse, the Coroner's statement respecting a diarrhœal outbreak there was fully confirmed.

With regard to the history of Harriett C., it appeared that she left the Workhouse on the morning of Tuesday, October 10th (a liberty day for the inmates), with the object of paying a visit to her niece at Royal Street, Lambeth.

Mrs. C. took the tramcar from Greenwich to Lambeth, but on the way vomited freely. At the end of the journey she was met by her niece, who had some difficulty in getting her aunt to Royal Street, owing to the vomiting which still continued. The patient, after her arrival at Royal Street, continued to suffer from vomiting, and from diarrhœa also. She died in collapse at 8.45 a.m. October 11th. Mrs. C. had, it appeared, been troubled with some diarrhœa prior to her excursion on October 10th, but it was not considered, either by her or by the nurse, of sufficient moment to prevent her paying a visit to her niece. She was, it seems, very liable to passing attacks of diarrhœa.

The post-mortem examination of Harriett C. was made by the officers of the London County Council, and I was instructed to watch the autopsy on behalf of the Board. As the examination revealed no sufficient evidence as to what was the cause of death, a portion of the ileum, together with its contents, was excised and forwarded to Dr. Klein for bacteriological examination, while the stomach with parts of other viscera were reserved pending the Coroner's instructions.

Dr. Klein's interim report, dated October 14th, upon the results of microscopical and cultural examination of the contents of the ileum, was as follows:—"The microscopical examination of the contents of the "ileum of Harriett C., who died at Lambeth, showed the presence, "amongst crowds of various bacteria, of some forms which were "undoubted commas, and revealed also even free flagella of commas; "but the cultivations yielded negative results."

Upon receipt of the above information, I was directed by the Board to make detailed investigation of the outbreak of diarrhœal disease at the Greenwich Workhouse, with which the case of the woman C. had been obviously related.

Before proceeding with an account of the outbreak at the Greenwich Workhouse it will facilitate the narrative that is to follow if a general description of the Workhouse and Infirmary be here given.

Greenwich Union Workhouse and Infirmary.

Site.—The site upon which these two buildings stand is situated at Maze Hill, Greenwich, in latitude 51° 29′ 6″ N. and longitude 0° 0′ 39″ E.

Its area is about 8 acres in extent, and it has a gentle slope from south-east to north-west. At its lowest part the site is about 11 feet above Ordnance Datum. On the east and south the site is surrounded by houses, from the curtilages of which it is separated by a high brick wall. On the west and north it is cut off by means of a similar wall from the Woolwich Road and the Vanbrugh Hill. A little to the south-east, and at a higher level than the site, is the Royal Hospital Cemetery, where interments take place at distant intervals.

Geology.—It will be seen by reference to the maps of the Geological Survey of this district that a "fault," or dislocation of strata, running from N.E. to S.W., is depicted as intersecting the Workhouse site. The relations thus indicated of the Workhouse and the "fault" raised question whether one or other of two wells which supplied the inmates of these institutions with water passed into or through the "fault;" in a way to draw water from the River Thames, across which the "fault" extends, or from the Deptford Creek which also apparently passes over it. And some evidence appeared in support of this view from a record of the strata which were stated to have been passed through in making the Greenwich Workhouse well.* This record gives the thickness of Thanet Sand at this point as but 11 feet, whereas the average thickness of this bed hereabouts would seem to be much in excess of this. My attention was drawn to this latter point by the late Mr. W. Topley, F.R.S., of the Geological Survey, who kindly afforded me some valuable assistance. In my endeavour to localise this "fault," I was also much aided by Mr. T. V. Holmes, F.G.S., late of the Geological Survey and now resident at Greenwich, who, after comparing several well borings and sections in the neighbourhood, came to the conclusion that the course of the "fault," as represented on the geological map, was too far to the south; that really it passed not through, but just to the north of the Workhouse site. It appeared, too, that when the second well, that for the Infirmary, was sunk, Chalk was struck after penetrating 30 feet of gravel; a fact which seemed to indicate that this well was to the south, or on the upthrow side, of the "fault," since none of the lower Tertiaries, such as Blackheath and Woolwich beds and Thanet Sands, were found here.

Reviewing all the evidence obtainable, it seems probably that both Workhouse and Infirmary are situated on the river gravel overlying Chalk, and to the south of, instead of on, the "fault."

The Workhouse consists of a main building, and of several accessory buildings. The main building occupies a large area in the northern section of the site, and extends east and west almost to the boundaries. Immediately south of it is another building known as the "Old Infirmary," which communicates with the main building by a covered passage. To the north and structurally distinct from the main building, are two blocks of wards, more recently erected than the others, known as the

* Geology of London (Whitaker), Vol. II. Greenwich Union Workhouse. Dr. J. Mitchell's MSS., Vol. IV.

—	Thickness in Feet.	Depth in Feet.
Earth	5	5
Gravel	2	7
Blue clay	30	37
Coloured clay	6	43
Sand	11	54
Chalk	30	84

East and West Blocks. Between these two blocks, but cut off from them by walls and airing courts, are the male and female "receiving rooms" and other offices of the institution; and on the eastern confines of the main building are the casual wards and the stone-breaking sheds, both of them separate from the Workhouse and entered from a separate gateway. Wards and blocks to the west of the centre of the institution are, in the main, occupied by males, those to the east of the centre by females.

The Infirmary is situated to the south of, and at a higher level than, the Workhouse proper; the site upon which it stands being, however, practically continuous with that of the Workhouse. The Infirmary buildings are arranged on the pavilion principle; there being four pavilions (two male and two female), with an administrative block. The pavilions and the administrative block communicate one with another by means of closed corridors. Access to the Infirmary is obtained by an entrance separate from that to the Workhouse.

Inter-relations of the Workhouse and the Infirmary.—Though these establishments are structurally and administratively separate institutions, and though (as will presently be seen) they have different water-supplies, they possess certain conditions in common. They are drained to a common sewer, and the chapel (as also the mortuary) is common to both insitutions. Moreover, there is not infrequent communication between them by means of their officers, as for instance the medical attendants and the chaplain, and in other ways. Thus, cases of serious illness which occur in the Workhouse are, if necessary, removed for better observation to the Infirmary, and all cases of illness in the Workhouse are visited frequently by the medical officers of the Infirmary. In addition, on every Tuesday, between 2 and 4 p.m., patients in the Infirmary are visited by their friends in the Workhouse, while on every Sunday Infirmary patients are visited by their relatives and friends from outside.

Communication between the Workhouse and the outer world is frequent. The first and second Tuesday in each month are "liberty days," the first Tuesday for the males and the second Tuesday for the females. Husband and wife are allowed out together on the "male" days. On every Monday there are visitors from the outside to the Workhouse. There are, too, the daily visits of the tradesmen, the journeyings to and fro of the Workhouse messengers, the arrivals in the receiving room, and some irregular visiting of friends and relations owing to special circumstances. On Sundays and Wednesdays those inmates of either the Workhouse or the Infirmary, who are so disposed, have opportunity of attending service in the chapel.

As regards drainage arrangements, there is not need for the purposes of this report to enter into a detailed description of the drains, either of the Workhouse or Infirmary. The main part of the former building was erected about 1840, with additions and alterations in the years 1843, 1876, and 1886; while the latter was completed in 1876, and additional blocks were built in 1889. Both Workhouse and Infirmary are drained to the public sewer in the Woolwich Road; in part separately, in part by a drain or drains common to both institutions. The drainage of the several parts of the total establishment varies according to the principles and practices in vogue at the time of their erection; and speaking generally the more recently erected Infirmary is far better off in the matter of drainage than the Workhouse. The main drains of the Workhouse are quite obsolete, consisting as they do of old brick barrels which pass under several of the inhabited portions of the building. The soil pipes in the older portions of the Workhouse are

either not ventilated at all or are ventilated quite inadequately; while occasionally they pass into old mason's traps. In some instances the closets are practically inside the wards, *i.e.*, are not cut off from them by any system of cross ventilation; and the soil pipes are inside the buildings. The closet pans are often inadequately provided with flushing apparatus. Baths and lavatory wastes are, in the older portions, neither properly trapped nor disconnected, and rain-water pipes are, in many instances, not cut off from the drains as they should be. In some cases an attempt has been made to ventilate the soil pipe by means of combining it with a rain pipe, a condition of affairs which tends to diminish the ventilating value of the soil pipe ventilator, at a time when there is the greatest need for relieving pressure in the drains. In almost all these respects the Infirmary contrasts favourably with the Workhouse.

History of the Outbreak.

At the date of the outbreak the Workhouse contained 586 males, 567 females, and 26 infants of both sexes. Similarly the Infirmary contained 227 males, and 153 females, making a total for the combined institutions of 1,559.

The subjoined table will assist the reader in following the account now to be given of the inception and progress of the outbreak.

Date.	Workhouse.			Infirmary.			Cases imported from outside.	Total Cases.
	Average Number of Inmates, 1,155.	Total Number of Wards, 104.	Number of Nurses, 12.	Number of Inmates, 440.	Number of Wards, 32.	Number of Nurses, 40.		
	Number of Inmates attacked.	Number of Wards freshly invaded.	Nurses attacked.	Number of Inmates attacked.	Number of Wards freshly invaded.	Number of Nurses attacked.		
Oct 4 -	1	1	—	—	—	—	—	1
„ 5 -	0	0	—	—	—	—	—	0
„ 6 -	2	2	—	—	—	—	—	2
„ 7 -	12	7	—	—	—	—	—	12
„ 8 -	15	12	—	—	—	—	—	15
„ 9 -	63	23	—	—	—	—	—	63
„ 10 -	31	3	—	—	—	—	—	31
„ 11 -	32	4	—	1	1	—	—	33
„ 12 -	18	3	—	1	1	—	1	20
„ 13 -	16	2	—	—	—	—	—	16
„ 14 -	16	2	—	—	—	—	2	18
„ 15 -	12	3	1	—	—	—	1	14
„ 16 -	6	2	—	—	—	1	—	7
„ 17 -	7	2	—	—	—	—	—	7
„ 18 -	1	1	—	—	—	—	—	1
„ 19 -	0	0	—	—	—	—	—	0
„ 20 -	2	0	—	—	—	—	—	2
„ 21 -	0	0	—	—	—	—	—	0
„ 22 -	4	0	2	—	—	—	—	6
„ 23 -	0	0	—	—	—	—	—	0
„ 24 -	0	0	1	—	—	—	—	1
Totals -	238	67	4	2	2	1	4	249

The first case coming to the knowledge of the medical staff occurred on *October 4th*. The patient, a male, aged 74 years, had been resident in the Workhouse for eight years. He had been out on leave on October 3rd, which was a "liberty day" for the male inmates. On that occasion he visited his sister, who lived at Greenwich; but, so far as the evidence I was able to obtain went, he did not then come in contact with anyone affected with the symptoms characteristic of the outbreak, nor did he consume anything which might have been likely to cause his attack. He may, of course, have been developing the illness before he went out.

The next two cases that came to the knowledge of the officials occurred on *October 6th* on the female side of the Workhouse; both were able-bodied inmates.

On October 7th there were 12 females, distributed in seven different wards, of the Workhouse attacked. These wards were situated in all parts of the female side, except that known as the "East Block," a detached building containing 119 females. There were on this day no recognised attacks amongst the males.

On October 8th several seizures occurred on both the male and the female sides of the Workhouse. There were attacked four males in as many different wards, including one case in the "West Block," containing 119 infirm males; and 11 females in 10 wards. So far, however, no case had occurred in the "East Block."

On October 9th the heaviest incidence of the disease took place, there being in all no less than 63 attacks, all in the Workhouse, of whom 29 were males and 34 females. Both the East and West Blocks suffered severely on this date, and there were altogether 13 male and 21 female wards involved.

On October 10th 10 males were attacked, eight separate wards on this side of the Workhouse being involved; while on the female side 21 inmates, distributed in 12 wards, were attacked.

On October 11th eight males, inhabiting six different wards of the Workhouse were attacked; and one case (on the male side) in the Infirmary. On the female side of the Workhouse 24 inmates, inhabiting 17 wards, were attacked.

On October 12th three males, in three separate wards, were attacked; and 15 females in 14 wards. All of these in the Workhouse. Also there was one female attacked in the Infirmary; and one female case was imported from outside.

On October 13th seven males in the Workhouse were attacked in six wards; also nine females in nine wards.

On October 14th six males in six wards, and 10 females in seven wards, were attacked; all of them in the Workhouse. One female and one male were brought in ill from outside.

On October 15th was the last day on which any male inmates were attacked, there being then six attacks in four wards on this side of the Workhouse; while one case was imported. On the female side six inmates were attacked in the same number of wards. In addition to these cases, one of the nurses who was in attendance on the patients in the East Block, was attacked.

On October 16th six female cases occurred, distributed in five wards of the Workhouse. There was also attacked on this day one of the Infirmary nurses who was in charge of the patients removed there from the Workhouse.

On October 17th seven females were attacked in six wards of the Workhouse.

On October 18th there was one girl in the "nursery" of the Workhouse attacked.

On October 19th there were no attacks.

On October 20th two cases occurred among females in different wards of the Workhouse.

On October 21st there were no attacks.

On October 22nd there were among the female inmates four attacks in three wards of the Workhouse, and in addition to these, two of the nurses in attendance upon the patients in the West Block were attacked.

After this there were no attacks among the inmates, but on *October 24th* one of the nurses in charge of the patients of the East

Block of the Workhouse was attacked, and on October 27th she had a serious relapse.

Reviewing the outbreak as a whole, it will be seen that it extended over a period of twenty days, *i.e.*, from October 4th to 24th, and that it was almost wholly limited to the Workhouse.

The distribution of the 249 attacks will be seen at a glance at the following summary :—

238 inmates of Workhouse attacked.
2 „ Infirmary „
5 nurses.
4 cases from outside.
249

The fatal attacks numbered 11.

The attacks were distributed over all parts of the Workhouse, though that occupied by the able-bodied males suffered hardly at all. The children's quarters, too, were almost completely exempt.

In a large number of wards there were cases day by day, and it was noticed that they frequently occurred in the adjoining beds.

Although the first case occurred in the Workhouse on October 4th, it was not until the 8th and 9th of the month that the West and East Blocks became respectively invaded. And the Infirmary was not implicated before the 11th.

Clinical and other Features of the Malady.

Symptoms.—In some persons and perhaps, as a rule, the attack commenced quite suddenly. In many cases the patients awoke from their sleep in the early morning with severe abdominal pain, rapidly followed by diarrhœa and vomiting. In a large number there were, in addition, severe cramps in the feet, legs, and abdomen, so that the patient became drawn up with pain. The patients were in the more severe cases much collapsed, and in some cases fainted in the latrines. Their features became contracted, their lips and extremities blue and cold, their voices feeble, and they suffered from intense thirst. As regards suppression of urine, I was unable to obtain any reliable information, more especially as in the worst cases the excretions were passed into the beds. No symptoms of uræmia were noticed in any of the cases.

It should be borne in mind that the above remarks apply to the severe cases, and that the severity of the attacks ranged from an illness resulting in death in 24 hours, to a mild and transient attack of diarrhœa; in fact, there were doubtless a large number of cases, especially among the males, which produced such slight inconvenience that they were not reported or classed at all. In a few cases patients were reported to have suffered from hæmatemesis, in others from melæna. In some instances vomiting was quite absent. At no time was anything like an eruption or rash observed on the bodies of patients suffering from the outbreak.

Premonitory Diarrhœa.—Early in the course of my examination of those who had been attacked, I was impressed with the fact that a considerable number had, for two or three days prior to the sudden onset of their acute symptoms, been affected with looseness of the bowels. I am unable to give the exact number of cases in which this symptom was present, but the occurrence was of sufficient frequency to justify its being taken into consideration in estimating the nature of the outbreak.

Nature of Motions and Vomit.—The motions in all the well-marked cases were of a liquid nature, some very much more so than others. The colour of the motions, according to the patients themselves, seems

to have varied very considerably, and to some extent this variation may have been due to the stage of the attack at which the patient took especial note of this. During the course of my inquiries I was, however, so impressed with the limited notions of colour which the Workhouse inmates possessed, that I am disinclined to attach much importance to their statements on the matter. The specimens seen by me varied in colour from light clay to a dark brown. Not one that I saw could be regarded as a typical rice water evacuation, though in some cases there was an approach to this condition. It is perhaps a point worthy of note that the peculiarly offensive odour which is said to be so frequently associated with the evacuations of persons ill from "food-poisoning" was absent, so far as I had opportunity of observing or ascertaining in these cases.

As regards the vomit, it too naturally varied much both in colour and consistency. It was described by the attendants as yellow, brown, black, frothy, green, white, dark, watery, &c. In the specimens that were shown me—many in number—the presence of bile was very conspicuous. In no instance did I see any typical "rice water" vomit. In the worst cases the vomiting was described as "constant;" in the milder cases it was infrequent, and in some there was nausea only.

Temperature and Pulse.—Unfortunately at the time of the outbreak owing to the junior assistant medical officer having recently left the service, the medical staff at the Workhouse and Infirmary comprised two medical men only. They had to attend, not only to the patients transferred to the Infirmary, but also to the numerous cases which day by day arose in the Workhouse. Under these circumstances the time, not only of the medical officers but also of the whole staff, was fully employed in meeting difficulties of administration, which consisted, primarily, in arranging for the isolation of those attacked, and for the disinfection of infected articles. Little leisure was found for detailed record of clinical observations.

Relapses.—Out of the total 249 cases which occurred, there were 13 which, within a week, suffered from a relapse of their symptoms. In some cases the relapse was of a more severe character than the primary attack, and gave rise to far more prostration. It is of course impossible to say, definitely, whether these secondary manifestations, which occurred in 5·2 per cent. of the cases attacked, are to be regarded as relapses or as re-infections; but looking at the short interval which intervened between the primary and secondary manifestations it would seem on the whole more reasonable to regard the recurrences of symptoms as relapses. It may be said then that there was a distinct tendency towards relapse in the disease.

Complications and Sequelæ.—Unless the relapses referred to above are to be considered in the light of complications or sequelæ, the disease under consideration must be regarded as entirely free from them. It is true that some of the patients died many days after they were attacked; but in these there were no signs of any implication of other viscera, and death was apparently caused by the inability of the patients, owing to their advanced age, to rally from the state of collapse produced by the exhaustive character of their illness.

Sex and Age in relation to the Disease.—As to *sex*, it will be seen, on referring to Addendum No. 4, that of the 238 attacks there recorded as having occurred amongst the Workhouse inmates, 164 were females and 74 males. This great excess of incidence upon the females cannot, as will be apparent from the Addendum referred to, be accounted for by any excess of females in the institution. Also, it has been seen that the females were day after day attacked in greater

numbers than the males, and furthermore that the females continued to be attacked for several days after the outbreak had ceased on the male side of the Workhouse.

As to *age*, Addendum No. 4 also serves to show the incidence of the disease on certain age groups. From this it will be seen that, having regard to the number of inmates at each age, there was a distinct predilection of the disease for the age groups "16–60" and "60 and over," more especially the latter; while in regard to the three age groups "9–16," "2–9," and the "infants," there was a very remarkable exemption from attack.

The children of both sexes under 16 years old are accommodated, as a general rule, in rooms, the "Nursery," in which they are kept quite distinct from other inmates of the Workhouse, and during play-hours they are restricted to play-grounds set apart exclusively for their use. There are, however, occasional exceptions to this arrangement, and a few of the quite young infants are sometimes kept in the adult wards for convenience of nursing, whether by their mothers or others of the inmates.

Amongst the children who were confined to the nursery rooms there was, throughout the whole outbreak, but one case bearing any resemblance to those occurring in the rest of the institution. This was that of a girl, aged 14, who, on 18th October, was attacked with violent vomiting and diarrhœa. But whilst among the few infants in the general wards of the Workhouse no typical attacks occurred; it was noticed that several of them, during the period of the outbreak, were attacked with smart diarrhœa.

Case Mortality.—There were in all, including the case of Harriett C—— who died at Lambeth, and that of William A., the nature of whose attack may be thought doubtful, 11 deaths attributable to the outbreak under consideration. Of the 11, six were females and five males, numbers which give a considerably higher case mortality amongst the males than females. The total number of deaths in each instance is, however, too small to base any reliable deductions upon.

The death-rate of all those attacked amounted to 4·4 per cent.

The ages at death ranged from 64 to 92, the majority of fatal cases being over 70 years of age.

The length of the illness from onset to death varied from 24 hours to as much as 11 days. The following is a list of the fatal attacks:—

Fatal Cases.

Name.	Age.	Date of Attack.	Date of Death.	Remarks.
Mary A. - -	77	Oct. 9th	Oct. 10th	
Harriett C. -	71	„ 9th	„ 11th	Died in Lambeth, while on leave.
Mary W. - -	92	„ 10th	„ 11th	
William C. -	68	„ 8th	„ 12th	
Jane C. - -	86	„ 12th	„ 13th	
Obadiah P. -	74	„ 9th	„ 13th	
William A. -	78	„ 9th	„ 14th	
Michael S. M. -	64	„ 9th	„ 15th	
William N. -	76	„ 9th	„ 15th	
Elsie T. - -	65	„ 11th	„ 27th	Vomiting and diarrhœa up to October 18th, never rallied.
Sarah H. - -	68	„ 9th	„ 30th	Unable to rally.

Pathology.—The post-mortem examinations of the fatal cases, were performed by Drs. Burney and Keats, the medical officer and the assistant medical officer of the institution; and to them I am indebted for the *précis* of their observations, which will be found annexed to this report. It will be seen that beyond a marked injection of the small intestines, more especially towards the lower end of the ileum, and an empty or contracted state of the bladder, nothing abnormal was generally observed.

Means of Distribution of the Disease.

It is first of all necessary to consider whether there has been at work any common medium by which the disease was conveyed to the persons attacked.

Drainage.

Inasmuch as the outbreak was almost wholly confined to the Workhouse, and, since the drainage of the Workhouse buildings was in large part obviously defective, whereas that of the Infirmary was much more modern in character, there must of course arise the question of possible relation of the disease to drainage.

To some extent, too, a theory of drainage causation of the outbreak would receive support from the consideration that the drainage of the Workhouse was, with the exception of a portion of the East Wing, well nigh distinct and separate from that of the Infirmary. But it so happened that the earliest manifestation of the outbreak among the females appeared in that section of the East Wing which has drainage in common with the Infirmary; and accordingly the almost complete escape throughout of the Infirmary hardly appears consistent with drain causation of the malady. Again, as regards the Workhouse, the several sections of it differ greatly in the matter of efficiency of drains; nevertheless sections of the Workhouse that were well drained suffered quite as much as sections that were ill drained. Moreover, as regards the male side of the house, the worst drained portion was almost exempt from attack. Further, there were no cases at all recognised as occurring in the "boys," who occupied a portion of the "old infirmary" at the Workhouse, where the drainage was particularly defective.

Upon the whole, therefore, it appeared that no satisfactory explanation of the outbreak was to be found in the conditions of drainage of one and another section of the establishment.

Water Supply.

On the other hand, there is no doubt that in many particulars the outbreak bears resemblance to some which have been regarded as due to the consumption of specifically polluted water or food.

Here were situated, practically side by side, two institutions having, broadly speaking, all things in common, with one exception; an exception which appeared at first to offer a sufficient explanation of the phenomena observed. Each institution was supplied by a separate well, and at the beginning of the outbreak—as also subsequently—the inmates of the Workhouse were attacked by symptoms which could apparently be explained on a thesis of polluted water, those of the Infirmary were free from all such manifestations. And furthermore, other facts, ascertained as matter of first instance, tended substantially to strengthen the case against the water.

The Workhouse Well is situated not far from the centre of the Workhouse site, and has erected over it a four-storied building some 53 feet in height, supporting an iron tank, having a capacity of 10,000 gallons, and furnished with an overflow pipe properly disconnected from the drains. The well consists of an excavation 5 feet in diameter,

carried to a depth of 10 feet 6 inches below the surface of the ground, and lined and floored with brick in cement. From the bottom of the excavation a bore hole, lined with an iron tube 12 inches in diameter, descends to a depth of 56 feet 6 inches. This iron tube projects upward for a few inches into the excavation above referred to, and is perforated with holes at its junction with the floor, to allow passage back into the tube of any water which may find its way into the excavation from the dripping of the pumps situated therein. The above statement as to the depth of the bore is based upon a sounding made by the engineer at a time when the suction pipe was out for repair; but the record in the Geological Memoir already referred to gives the total depth of the well as 84 feet. Several attempts were made at the time of my inquiry to ascertain, without disturbing all the pumping machinery, the exact depth of the well, but the projections at the joints of the suction tube prevented even a small piece of lead from passing down the bore below the first junction. On the last occasion when an opportunity of ascertaining the level of the water in the bore occurred, it was found, so I was informed, to be 11 feet 4 inches below the bottom of the well, *i.e.*, 21 feet 10 inches below the ground level. On examining the inside of the brickwork of the excavation from above, it appeared to be perfectly water-tight; but subsequently, not being satisfied with this inspection, I descended, in company with Mr. Keats, the senior assistant medical officer of the Infirmary, and made a careful examination of the sides. We found low down, close to the floor, distinct evidences of moisture, and it appeared that the moisture was due rather to fluid oozing inward through the brickwork than to the condensation of aqueous vapour upon its surface. On the floor of the excavation there were, here and there, small pools of water.

Within 14 feet of the workhouse well there existed an old brick barrel drain, and having regard to the general condition of the workhouse drainage little doubt could be entertained as to the likelihood of communication between this drain and the well. When too a specimen of this well-water, drawn by Dr. Downes from a tap in the Workhouse, was submitted to Dr. Klein for bacteriological examination, the existence of a comma bacillus, bearing strong microscopical resemblance to the bacillus of Asiatic cholera, was discovered in it; and there were also found in the same sample other micro-organisms not present in pure drinking water.*

Endeavours were made on two occasions to ascertain the existence of any communication between the drain and the well. For this purpose the drain was plugged, and large quantities of carbolic acid placed therein. The drain was allowed to remain blocked for some 48 hours, and the water from the excavation above the iron tube, as also from the well, was then frequently tested, but without detecting the existence of carbolic in it. Subsequently a similar experiment was attempted with paraffin oil, but the results were still negative. Again, an excavation was made just outside the wall of the pump-house, and a large quantity of cochineal having been placed therein, the water in the excavation and well was from time to time examined for the presence of this dye; none, however, could be detected. Nevertheless, it is quite possible, and in fact, looking at the result of Dr. Klein's analysis of the water, probable, that some connexion did exist between the well and the drainage of the workhouse, though the individual drain which was the subject of our experiment might not have been at fault.

From the well, the water is pumped up to the water-tower that has been referred to, and from this it is distributed to several cisterns in

* *See* Addendum No. 2.

various parts of the Workhouse buildings. In numerous cases the water-closets were supplied without the intervention of a separate cistern or service box; and as an instance of this condition of things may be mentioned the supply of some closets in one of the yards, which was discovered by Dr. Downes and myself in our preliminary inspection. In this case the closets were supplied direct from one of the main-service pipes as it descended from the water-tower, and in such a manner that ample opportunity under certain conditions would be afforded for the in-suction of closet air, if not of excrement, into the water main. Some 28 closets were subsequently discovered without any proper intercepting cisterns.

The Infirmary Well.—Concerning this well, which is of a much more modern date than that of the Workhouse, we have more accurate information.

It consists of an excavation carried down 37 feet until the chalk is reached; from this point a bore descends to the depth of 173 feet 8 inches below the surface. The excavation is 5 feet in diameter, and is lined in its upper part with bricks in cement and its lower with iron cylinders to keep out water from the superficial soil. Further description of the well is hardly called for here, since the water drawn from it was never seriously suspected of having been the means of disseminating disease. Moreover in addition to bacterioscopic examination by Dr. Klein of water from the Workhouse and Infirmary wells, samples from both were submitted to Dr. Frankland for chemical examination. He pronounced the former bad and the latter good.

Here then was a case against the water which seemed at first almost conclusively to incriminate it as the cause, or at any rate the vehicle, by which the disease was distributed.

With, however, further progress of the inquiry, grave doubts began to be thrown upon the water hypothesis. Not only was it seen that closure of the Workhouse well failed to at once put an end to the outbreak, but also it was found that the children, who were the chief consumers of the water, and who drank it at their meals and frequently at other times, were in effect exempt from attack. And conversely it became evident, in the course of a case to case inquiry which I conducted, that amongst the adult inmates, and more especially the females, consumption of water in an unboiled condition had been exceptional. Water when taken at all had been almost invariably consumed after infusion with tea, and—a point about which the female inmates are scrupulously particular—the water with which the Workhouse tea was infused had been actually boiling at the time the tea was made.

And here it should be said that in inquiring into the habits of the inmates with regard to the consumption of water, I took especial care to eliminate, as far as possible, all error by classing any of those concerning whom there was the least doubt, as "water-consumers"; and those who either cleansed their teeth or washed their mouths with water, were similarly classed. In all cases when the patient was in bed at the onset of the attack, I was able to check their statements by reference to the attendants. On the above lines I cross-questioned 129 of those attacked, and 28·6 per cent. were found never to have used unboiled water.

It became manifest, therefore, that although there appeared *prima facie* grave suspicion of the Workhouse water as having been the medium by which the disease was conveyed to the Workhouse inmates, and notwithstanding that the water in question was found to be polluted, the facts subsequently elicited failed to justify the inference that the disease had been waterborne.

Accordingly I passed to the question whether any article of food could be held to have been either the cause or the medium of conveying the disease.

Food.

The food supplied to the Workhouse and to the Infirmary is furnished by the same contractors, and is delivered to both establishments at the same time and in the same vans. For some time antecedent to the outbreak all food supplies received into the Workhouse passed directly through the hands of the Master, in consequence of the cook having left the service on September 12th; and the cook's successor was not appointed until after the outbreak was in progress. The Master stated that during the whole of that time no complaints as to the quality of the food reached him; though, of course, this is not a point of much consequence.

For the most part, articles of diet used in the Workhouse are also used in the Infirmary The food requiring to be cooked is prepared separately for the Workhouse and for the Infirmary. The staff are furnished in some instances with food of a rather better quality than the inmates, and this is the case, amongst other things, with regard to bacon, cheese, butter (the inmates are supplied with margarine of Dutch origin), tea, and coffee. No fish or tinned meats had been consumed by any of the Workhouse inmates. A copy, both of the Workhouse and Infirmary dietary scales, will be found annexed to this report, as also a table, Addendum No. 5, showing the daily incidence in the Workhouse of the disease upon each dietary class.

Notwithstanding that both the Workhouse and the Infirmary were supplied with food by the same contractors, and that the supplies were delivered at the same time in the same vans, the outbreak was confined, as has been seen, practically to the Workhouse. The only articles of diet which were used in the Workhouse and not in the Infirmary were oatmeal porridge, pea-soup, and suet pudding; and a glance at the diet tables and at the incidence of the disease on the respective classes for diet, will be sufficient to at once exonerate any of these articles from blame. For the rest, the Workhouse diets were divided into four classes.* Nos. 1, 4, 5, and "extra labour." These four diets comprise articles which may be enumerated as follows :—

1. Bread.	7. Suet pudding.
2. Oatmeal porridge.	8. Irish stew.
3. Meat.	9. Tea.
4. Bacon.	10. Butter.
5. Potatoes.	11. Beef-tea.
6. Pea-soup.	12. Milk.

Each of these articles of food was separately considered in its possible relations to the outbreak, but in every instance with negative results. Thus—

(1.) *Bread.*—This article of diet was common to each dietary class, and was consumed alike by adults and children. But as has been seen,

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* The four diets severally include—

No. 1 *Diet.*—Bread, oatmeal porridge, meat, potatoes, pea-soup, suet pudding, and Irish stew. Bacon once a week.

No. 4 *Diet.*—Bread, beef tea and milk.

No. 5 *Diet.*—Bread, butter, tea, meat, potatoes, pea-soup, suet pudding, and Irish stew.

Extra Labour Diet.—Bread, butter, tea, meat, and potatoes.

the children kept separated from the adults remained, with the exception of one case, free from the disease, and the Infirmary inmates who consumed the same bread were practically exempt from illness.

(2.) *Oatmeal Porridge* was consumed in the Workhouse by the able-bodied inmates alone, and only by those on No. 1 diet, but the outbreak was by no means confined to these persons.

(3.) *Meat.*—It was at first surmised that the outbreak might have been due to the consumption of New Zealand mutton, which is received into the Workhouse and also into the Infirmary in a frozen condition.

It soon, however, became apparent that this surmise was based on a too hasty generalisation, though it is not difficult to understand how the mutton came to be suspected; the majority of those attacked consumed mutton, and in some wards the only persons attacked were those into whose diet mutton entered. But on the other hand it had not been perceived that a considerable proportion of inmates who had no mutton at all nevertheless suffered in the outbreak; nor that in some wards, where the patients were all on mutton, no attacks took place. Furthermore mutton had been in common use in the Infirmary, which practically escaped attack.

(4.) *Bacon.*—This article of food was consumed only on Tuesdays, when all the patients, with the exception of those on No. 4 diet (beef-tea, milk and bread, and mutton), had an opportunity of taking it. The inmates on No. 4 diet were, however, by no means exempt from illness, no less than 21 per cent. of them being attacked.

(5.) *Potatoes.*—No potatoes were consumed by persons on No. 4 diet, who, as above seen, suffered considerably in this outbreak, while the children, who also consumed potatoes, were almost entirely exempt.

(6.) *Pea-soup* was not consumed by Workhouse inmates on extra labour diet, who suffered to the extent of 7 per cent. of their numbers. It was, however, partaken of by wardswomen and wardsmen, who were, as will be seen later, attacked in an exceptional degree.

(7.) *Suet-pudding.*—This was not included in the "extra labour" and No. 4 diets.

(8.) *Irish Stew.*—Had the same distribution as six and seven.

(9.) *Tea.*—The staff consumed a different tea to the inmates, and, as presently will be seen, they suffered severely in the outbreak. Moreover, inmates into whose dietary scale tea did not enter, were by no means exempt.

(10.) *Butter.*—With regard to butter (margarine), none was used by the Workhouse inmates on No. 1 and No. 4 diets, both of which classes suffered in the outbreak.

(11.) *Beef-tea* being only included in diet No. 4, may accordingly be excluded.

(12.) *Milk.*—This article of food was consumed only by children, and by adults on No. 4 diet, and the practical escape of children appeared inconsistent with any relation of the milk supply to the outbreak.

As to Infectivity of the Disease.

The evidence, therefore, having tended decidedly to exclude the water and the food at the Workhouse as media by which the disease spread among the inmates, it became necessary to consider whether after all the disease may not have been spread, as measles is, directly from person to person, or mediately by fomites, infected bedding, and clothing.

Early in the inquiry, it appeared to the medical officers of the Infirmary and myself that there were numerous facts in the history of

the outbreak that were quite consistent with possession by the disease of considerable infective power; and consequently everything, so far at least as the circumstances would allow, was at once done, by means of isolation and disinfection, to prevent its spread. The patients were transferred to and isolated in a separate block of the Infirmary, and all excreta, vomit, &c., as well as infected clothing, were carefully disinfected. Visiting between the Workhouse and Infirmary, as well as between both and the outer world, was suspended. And, as a matter of fact, when these measures were effectually carried out, the disease ceased to occur.

Among considerations tending to encourage belief in the infectivity of the disease are the following:—

In the Infirmary, which it will be remembered is an entirely separate building from the Workhouse, two well-marked attacks occurred in the course of the outbreak at a date antecedent to removal of cases from the Workhouse to the Infirmary. One of these was a male, the other a female, and they occupied different wards in separate blocks of the Infirmary. The male was attacked on Oct. 11th, the female on Oct. 12th, both attacks being quite typical of the general outbreak. On Oct. 10th the patients in the Infirmary had been visited by relations and friends from the Workhouse; and although it appears that neither of the inmates of the Infirmary that were attacked had personal friends visiting them on Oct. 10th, it is extremely probable, since they were both up and about in their wards, that they came then in contact with some of the visitors from the Workhouse, where there occurred on that day no less than 31 fresh attacks.

As regards the secondary cases in the Infirmary, the case of Nurse H., for instance, is difficult of explanation otherwise than by infection. She was the only nurse attacked in the Infirmary, and was in charge of one of the wards where some of the patients from the Workhouse were under treatment. In another instance one of the male employés in the Infirmary, who resided with his family outside the institution, was attacked with symptoms that Dr. Burney considered typical of the outbreak. This man was sent to his home, and a few days afterwards one of his children, who had not been inside the Workhouse or Infirmary, was attacked with similar symptoms. It should be stated that this man, although employed in the Infirmary, had visited the Workhouse from time to time previous to his illness.

The immunity of the children that were confined to the nurseries is best explained by regarding the disease as infectious. These children were for the most part kept entirely apart from the remainder of the inmates. They had a nursery and dormitory of their own, and playgrounds for their sole use; all their meals were taken apart from the adults, and in a different building.

On a theory of spread of the malady by infection it was to be expected that an excessive, or at any rate exceptional, incidence of the disease would be found among those brought most in contact with infected persons or things; *i.e.*, that the nurses and others in attendance in the wards, and the persons brought in contact with infected linen, &c., would be especially liable to attack. And on examination this was found to be the case, as follows:—

The Incidence of the Disease upon the Laundry Staff.

The laundry of the Workhouse, which is well constructed and ventilated, is situated at the eastern extremity of the "old infirmary." The

soiled linen is brought here from the wards by the wardsmen and wardswomen, deposited in the sorting room, and distributed to the various departments of the laundry. Linen, however, that is found coarsely fouled is received into a separate room, where it is soaked, before washing, in a tank containing a solution of Sanitas.

The laundry is worked by pauper labour, there being an average number of 50 inmates employed at the work. Among these 50 persons there were four attacks; and it is an interesting point that among the four were the only persons (two) engaged in dealing with the coarsely fouled linen. The two persons in the foul linen department were both attacked, whereas of 48 persons employed in the general department of the laundry, only two attacks occurred. Of course this attack rate of 100 per cent. upon those employed in the foul linen department may be only a coincidence, or may have other explanation than that suggested; but at any rate it is of value in summing up the evidence for or against infectivity of the disease.

Incidence of the Disease on the Wardswomen and Wardsmen.

The average number of wardswomen in the Workhouse is 34, and of wardsmen 24. These 58 persons assist in attending upon the other inmates, and in keeping the wards clean, &c. It would therefore be only reasonable to expect, assuming the disease to have been infectious, an exceptional incidence upon these individuals, since they would certainly be more likely to be brought into frequent and close contact with infected motions and vomit than the other inmates. This expectation has been fully realized, as out of 34 wardswomen, no less than 9 (or 26·5 per cent.) were attacked, while out of the 24 wardsmen, 6 (25 per cent.) were attacked.

Incidence on Administrative Staff.

The Workhouse Staff.—This consisted of the following persons, whose ages ranged from 20 to 51 years:—

Master - - -	1
Matron - - -	1
Assistant master - -	1
,, matron - -	1
Porter and wife - -	2
Labour masters - -	2
Receiving wardsman - -	1
Storewoman - - -	1
Cook - - - -	1
Laundresses - - -	2
Day nurses - - -	10
Night nurses - - -	2
	25

There were in addition to the above, two resident medical officers whose services were common to both Workhouse and Infirmary.

Of the total (25) Workhouse staff, four, or 16 per cent., were attacked, and all four attacks occurred among the twelve nurses in attendance upon patients suffering from the disease. It will thus be seen that the incidence upon these nurses was very considerable, *i.e.*, 33·3 per cent.

Infirmary Staff:—

Matron	1
Assistant matron	1
Steward	1
Head nurses	5
Nurses	29
Assistant nurses	6
Night superintendent	1
Male and female receiving attendants	2
House porters	7
	53

There was, so far as I am aware, but one nurse attacked amongst the Infirmary officers, and she was on duty in the block containing patients removed from the Workhouse for isolation into the Infirmary. This nurse was attacked on October 16th.

Whether this comparatively trifling incidence on the Infirmary staff may be accepted as testimony to the efficiency—as compared with the means adopted at the Workhouse—of the measures taken in the Infirmary for dealing with cases considered to be infectious, or is to be regarded as tending to discredit belief in the infectiousness of the malady that is in question, must be left to the judgment of the student of this report.

The greater incidence of the malady upon female than upon male inmates of the Workhouse certainly would seem consistent with infectiveness of the malady; though the observed difference may have been partly due to a greater natural tendency on the part of the females to make mention to the nurse or to one another of their ailments. Moreover, seeing that in both sexes a very large number of those attacked were inconvenienced only very slightly by their illness, and did not take to their beds, it is like enough that males would resort to the closets out of doors, and say nothing about the matter, whereas the females congregated together in their wards could not fail to observe the frequency of one another's visits to the closets. On the other hand, the greater tendency of females to sit by one another's bedsides, &c., would considerably increase the chances of infection, as also would the common use of a badly-flushed W.C., situated in some cases practically inside the ward. But, under equal conditions of confinement within doors, there did not appear any excess of incidence on females. Thus, in the West Block, where 119 infirm males were dealt with under exactly similar circumstances to 119 females in the East Block, there were 37 attacks, whereas in the East Block the attacks were only 29.

In exactly what way infection may have passed from the bodies of persons attacked to other persons it is impossible to say; but, having regard to the fact that the digestive system was always chiefly implicated at the onset of the malady, it may be believed, perhaps, that infection contained in the motions and vomit of the infected persons was conveyed from person to person by means of these ejecta. Transmission of infection by such means may have taken place in different ways. In the case, for instance, of the nurses and attendants on the sick, by direct personal contact with the excreta; in other cases, perhaps, by ingestion (after lodgment in the mouth) of particles of infective matter wafted about the crowded wards by air currents. Spread of diarrhœa from person to person in some such way, without actual personal contact, has already been noted elsewhere. Several localized outbreaks of infective diarrhœa, which occurred in the Rural Sanitary District of Helmsley in Yorkshire in the years 1876, 1880, 1882, and

1886, are recorded by Dr. Bruce Low in the supplement to the report of the Medical Officer for the year 1887.

THE NATURE OF THE DISEASE.

It will be well, in considering this question, to recall the fact that the Greenwich outbreak occurred at a season during which isolated cases, and small groups of cases, manifesting all the symptoms of Asiatic cholera and bacteriologically indistinguishable from that disease, were being reported from various parts of the country, and also in the Metropolis. The symptoms in the case of Harriett C——, the death of whom first attracted attention to the Greenwich outbreak, were certainly such as to suggest Asiatic cholera, and also the more severe cases at the Greenwich Workhouse seemed capable of being so regarded. It is true that the fatality of the Greenwich attacks was far below that usually observed in well-marked Asiatic cholera. But having regard to the frequently observed diminution of cholera fatality towards the termination of epidemics of that disease, the small fatality of the Greenwich malady did not necessarily entirely negative belief in its choleraic nature. Furthermore, when the motions of those first attacked at Greenwich were microscopically examined by Dr. Klein, suspicion that the outbreak was due to cholera was rather enhanced than diminished. It was in fact only when the material from these persons was submitted to the further scrutiny of cultivation and chemical test, that doubt was thrown on the strong indications of the primary microscopical examinations of their crude evacuations. The onset of the disease in individuals attacked at Greenwich bore, too, one may say, generally a very strong resemblance to cholera. In numerous cases premonitory diarrhœa, such as frequently ushers in attacks of Asiatic cholera, was present; and in many cases where such diarrhœa was absent, the sudden seizure characteristic of severe cholera attack was manifest. Certainly in the majority of the Greenwich cases, in which premonitory diarrhœa was not complained of, the attack commenced suddenly in the early morning. And as regards the onset of Asiatic cholera, I quote the following from Fagge's "Principles and Practice of Medicine." "It very often—" according to Lebert in more than half the cases—begins in the early " morning, perhaps waking the patient from sleep." The motions and vomit of the Greenwich cases were, on the other hand, by no means characteristic of Asiatic cholera, and although in a few instances they were thought to approach somewhat to a rice-water character, as a rule this was certainly not the case.

The post-mortem appearances of those persons at Greenwich who died of the disease were, except in one important particular, not inconsistent with death from Asiatic cholera; although it must be admitted that this statement is based upon the fact that the appearances were in a large part negative. The one common feature about all the post-mortem examinations under consideration, which must certainly be held to throw grave doubt upon the cholera theory, is the entire absence in the intestines after death of anything resembling a rice-water motion. The bowel contents in all the autopsies are reported to have been bile stained.

When, too, we examine into the age distribution of the disease at Greenwich Workhouse, it must be admitted that, having regard to the marked immunity of the children, a theory of cholera, and above all, of water-borne cholera, not only fails to receive any support, but, on the contrary, there are seen to be considerations militating against it. True, but little appears to have been written upon the age incidence of Asiatic cholera, but I am able to furnish an interesting table, showing

the experience, in 1892, of Hamburg in these respects.* It serves as a standard of age incidence of the disease in the recent manifestation of cholera in Europe, and it indicates that children—especially children under five years—are, when exposed to a common cause of cholera, by no means exempt.

Age Period.	Population, December 1891.	Cholera.		Rates per 1,000 Population.	
		Attacks.	Deaths.	Attacks.	Deaths.
Under 1 year of age - -	18,635	697	626	37·4	33·6
„ 1 to 2 years - -	15,434	624	490	40·4	31·7
„ 2 to 3 - - -	14,537	432	289	29·7	19·9
„ 3 to 4 - - -	12,936	348	219	26·9	16·9
„ 4 to 5 - - -	12,616	297	175	23·5	13·9
Under 5 years of age - -	74,158	2,398	1,799	32·3	24·3
„ 5 to 15 - -	122,444	1,731	776	14·1	6·3
„ 15 to 25 - -	125,390	1,959	744	15·6	5·9
„ 25 to 50 - -	237,013	7,127	3,520	30·1	14·9
„ 50 to 70 - -	66,858	2,002	1,369	29·9	20·5
Aged 70 and upwards - -	14,025	486	376	34·6	26·8
Unknown - - -	512	1,253	21	—	—
Totals - -	640,400	16,956	8,605	26·3	13·4

Finally, it will be seen from Dr. Klein's report, which is appended, that from the bacteriological point of view he is unable to regard the Greenwich malady as cholera.

As to the Relation of the Greenwich Malady to Influenza.

Early in the inquiry the possibility of the outbreak being of a gastro-intestinal variety of influenza had to be considered, and in this connexion it should be noted that at about the time the outbreak occurred recurrence of influenza was being reported from various parts of the country.

As regards the Workhouse itself, I was informed by Doctors Burney and Keats that no cases bearing any resemblance to influenza in any of its forms had come under their notice during the four months preceding the outbreak; and Dr. Hartt, Medical Officer of Health for Greenwich, had heard of no cases in Greenwich for a considerable time antecedent to this outbreak.

It seemed to me therefore, and still seems, improbable that so many cases of influenza, characterized all of them by gastro-intestinal symptoms, should have occurred with no intermediate forms whatsoever. Of course it is difficult either to prove or disprove a proposition of this kind, and unfortunately neither age nor sex incidence can aid in this connexion. Furthermore, it is difficult to determine exactly what value is to be attached to the presence or absence of the bacillus discovered independently by Pfeiffer, Kitasato and Canon, and regarded by them as the cause of influenza.

It will be seen, however, from Dr. Klein's investigations that the bacillus which he isolated from material afforded by the Greenwich cases, and which he appears to think may have been the cause of the outbreak, though bearing some resemblance to the influenza bacillus, differed in essential particulars from that microbe.

* Bericht des Medicinal—Inspectorats über die Medicinsche Statistik des Hambrugischen Staates für das Jahr 1892 by Dr. Reincke, pp. 31, 32.

The Malady observed at the Workhouse not limited to that Institution.

Soon after the commencement of my inquiry, I heard of cases of similar type to those in the Workhouse as having occurred in Mill Lane, Deptford. I was, however, unable to obtain any evidence, which I could regard as conclusive, that cases had arisen there prior to October 4th, the date on which the first case was heard of in the Workhouse. At a later stage in my investigations I was, by the kindness of Dr. Roberts, Medical Officer of Health for Deptford, enabled to obtain information of two deaths in adults which had resulted from diarrhœa and vomiting in his district. In one of the cases the history and all the symptoms bore an exact resemblance to the worst cases of the Greenwich outbreak. But although I spent a considerable time in endeavouring to trace out any connexion between them and the Workhouse, I was unable to do so; moreover, Dr. Roberts informed me that he had made careful inquiries at the houses of persons who had received, or who were stated to have received, visitors from the Workhouse, but he had been unable to ascertain the existence of any cases in such houses.

With respect, however, to Greenwich, my inquiries were more successful. At first it appeared that no cases had occurred outside the Workhouse, but subsequently, owing to information which came to my knowledge, partly by the kindness of Mr. Jordan, master of the Workhouse, I was led to suspect that the existence outside the Workhouse, of a disease similar to that which prevailed inside, had been by no means rare. In my inquiries in this direction, as also in others, I have to acknowledge the very material aid afforded me by Dr. Hartt, Medical Officer of Health for Greenwich. He was good enough to send a circular letter to all the medical practitioners in his district, asking to what extent diarrhœa and sickness, especially amongst adults, had been prevalent in their practices for some time antecedent and during the outbreak at the Workhouse. By the courtesy of these gentlemen, I was able to obtain information of a most valuable kind, which established the fact that there had been prior to and simultaneously with the outbreak in the Workhouse several cases of an exactly similar description in some parts of Greenwich, more especially in that part where the Workhouse is situated. The earliest cases of which I was able to obtain information were two which occurred not far from the Workhouse, on September 28th—*i.e.*, a week before the Institution was invaded—and subsequently to that date there occurred in the practice of some of the medical practitioners in Greenwich over twenty cases of a similar character. Two of these cases were those of medical men in attendance upon patients suffering from similar attacks, and the description which they were good enough to give me of their seizures (which were inexplicable upon any thesis of water or food ingestion) corresponded precisely with the typical attacks occurring in the Workhouse. There were not amongst those attacked with symptoms of this sort outside the Workhouse any deaths, but it did not appear that in Greenwich outside the Workhouse any persons of an advanced age had suffered from the illness.

From all the facts here adduced, I conclude that, in all probability, the disease which spread so widely amongst the inmates of the Greenwich Workhouse was introduced into that institution from without. By what person or by what agency it was so introduced, I was unable to ascertain. Having once been introduced, it may have spread, so at least the balance of evidence would seem to indicate, rather by means of personal infection and infected dejecta, and the like, than by the agency of any common vehicle such as water or food.

ADDENDUM No. 1.

App. C.

On an Outbreak of Diarrhœal Illness at Greenwich Workhouse, Oct. 1893; by Dr. Bulstrode.

Report by Dr. Klein on the Results of Bacteriological Examination of Material from the Bodies of Inmates of the Greenwich Workhouse attacked by Diarrhœal Illness.

No. 1.—H. C., *æt.* 71, an inmate of the Greenwich Union Workhouse, died on the morning of 11th October, while on a visit at Lambeth. From this case I received after the post-mortem examination on October 12th a piece of ileum. The gut was intensely congested, and it contained a brownish slightly blood-tinged fluid. On microscopic examination crowds of bacilli were detected, some very short cylinders, others long; some also that were threadlike. Among them were present some few forms that looked not unlike commas, and here and there also a free flagellum. Cultivations made in peptone salt solution and in gelatine plates yielded negative results; no commas made their appearance.

No. 2.—Fluid vomit of F., received October 13th. On microscopic and cultural examination, no commas could be detected.

No. 3.—Semi-fluid brownish fœcal stool of J. Received on October 13th. Microscopic and cultural examination yielded negative results as regards commas.

No. 4.—A piece of ileum from the body of J. C. Received October 13th. The specimen was deeply congested, and contained a brownish fluid. On microscopic examination flakes were found, consisting of epithelial cells with crowds of bacteria, the latter represented by short oval or cylindrical rods, and by threadlike forms. A few suspiciously comma-shaped bacilli were also found. Cultivations made in peptone salt solution, and in gelatine plates, did not, however, yield commas.

No. 5.—A stool of F. (see also No. 2). Received October 16th. This material was semi-fluid, brownish and distinctly fœcal. Amongst the crowds of bacteria contained in it were some which were distinctly comma-shaped, with flagella attached to them. There were also present free flagella. Cultivations were made in peptone salt solution. After 10 hours incubation at 37° C. the culture medium had become slightly turbid, and preparations made from the top layers showed a distinct crop of commas. Sub-cultures were therefore made in fresh peptone salt solution, and also in gelatine plates, and both media yielded almost pure growths of comma-shaped bacilli. But they were not true cholera commas; for they grew much more rapidly in gelatine than Koch's bacillus, and they liquefied this medium with rapidity, making it turbid. In peptone salt solution, they grew only slowly at 37° C., much more rapidly at 20° C.; moreover when grown at 37° C., they gave no cholera red reaction. On potato they formed, when grown at 37° C., after 2-3 days a brownish growth. On comparing them with Finkler's commas they were found to resemble this organism in every respect. A second stool obtained later from the same patient yielded on microscopic and cultural examination only negative results.

No. 6.—Ileum from the body of P. The specimen was much congested, and contained brownish fœcal semi-fluid matter, in which were crowds of bacteria. Cultivations proved negative.

No. 7.—A piece of ileum from the body of W. N. Received October 17th. The gut was deeply congested in parts. It contained no fluid, only greenish fœcal matter. In its epithelium, scraped from the mucous membrane, there were found crowds of straight bacilli, some oval, some cylindrical, others filamentous. They were all of the same thickness, and might therefore belong to one species. Cultivations proved negative as regards comma bacilli.

No. 8.—A fluid greenish stool of F. G. Received October 17th. Numerous bacteria were found in this specimen, but no definite commas. Cultivations proved negative; no comma bacilli appeared in them.

No. 9.—A piece of ileum from the body of M. M. Received October 17th. The specimen was deeply congested in patches, and contained semi-fluid yellowish brown fœcal matter. Samples under the microscope showed a considerable number of threadlike chains of bacilli, with single cylindrical and oval rods. Cultivations were made, but the result was negative as regards commas.

No. 10.—A fluid brownish stool of B. F. Received October 17th. Amongst a crowd of straight bacilli (oval, cylindrical, and threadlike

chains) there were some undoubtedly comma-shaped bacilli, and also some free flagella. Cultivations were made in a considerable number of tubes of peptone salt solution, as well as in gelatine plates, but the result was negative; no colonies of comma bacilli appeared.

No. 11.—A brownish fluid stool of M. H. Received on October 17th. Amongst crowds of bacteria there were a few bacilli which might be taken for commas, and also a few flagella. Cultivations were made in several tubes of peptone salt solution and in several gelatine plates, but the result was negative as to comma bacilli.

No. 12.—A brownish fluid stool of E. C. Received October 20th. This person lived in Mill Lane, Deptford, not in the workhouse. The material contained numerous mucous (non-epithelial) flakes, in which were crowds of bacteria, singly and in clumps, apparently bacillus coli. In addition there were present some thin cylindrical and filamentous chains of bacilli. Amongst the latter cylindrical bacilli were some which looked slightly curved, as well as some long thin homogeneous spirals. Cultivations were made in several tubes of peptone salt solution, and in several gelatine plates, but the result was entirely negative. No comma bacilli made their appearance.

Regarded from the pathological view point, the malady from which the foregoing persons suffered cannot be considered true cholera.

Not one of the stools submitted to me had the rice-water character, nor did any specimen of ileum received by me contain "rice-water" material. Moreover, in no case did culture of these materials in peptone salt solution yield unquestionable cholera comma-bacilli. It is of course quite possible to fail now and again in cases of true cholera to obtain positive evidence of the presence of the cholera commas. Others besides myself have recorded such failure. But seeing that from not one of the many samples tested could the cholera bacillus be isolated by peptone culture—a medium which I have elsewhere pointed out is almost infallible in picking out cholera commas from among multiple and similar microbes—there is no escape from the inference that these Greenwich cases were not of the nature of true cholera.

Nevertheless this Greenwich malady was characterised by the presence in the evacuations of certain living patients, and in the bowel contents of not a few of the fatal cases, of a definite micro-organism. Morphologically this organism was a bacillus, occurring either in oval or cylindrical rods or as filamentous chains. In well stained and well washed preparations these bacilli appear peculiar in the circumstance, that individuals show a faintly stained sheath with a stained granule at each end; the shorter forms appearing like diplococci from their ends being rounded. In all cultivations from the Greenwich cases these bacilli appeared in large numbers. In the early peptone cultures of some of these cases they seemed the only bacilli present, and in the gelatine plate cultures numerous colonies of them could be recognised. In peptone or in both cultures these bacilli grow well and produce rapidly a uniform turbidity; in gelatine plates they appear after 24 hours as minute grey dots, which in 36 hours have formed small pits due to commencing liquefaction of the medium. After 2–3 days, each greyish white dot has enlarged, and appears granular, the zone of liquefied gelatine around it having increased and become slightly turbid.

Microscopic preparations made of the colonies of a gelatine plate, or of peptone, or of broth cultures, show the bacilli, whether in the form of short ovals, thin longish cylinders, or slender long and short filaments, as activity motile; the filaments either rapidly progressing and at the same time oscillating, or moving in a serpentine manner. In stained specimens these filaments are seen to be composed of rods, short, oval or cylindrical. All forms show in the single individuals the bipolar staining well marked. In thickness and in the pronounced bipolar staining the short forms resemble* the Influenza bacillus, as also in the circumstance that they form on agar circular flat translucent colonies, each with a minute white dot in the centre. But they differ from the Influenza bacillus in that they are motile, and that they grow well and rapidly liquefy gelatine at

* Further report and papers on Epidemic Influenza 1889–92, with an introduction by the Medical Officer of the Local Government Board (Eyre and Spottiswoode).

20°C. In motility, in the very great differences in length of these bacilli —length varying between short ovals and long threads—and in their rapid liquefaction of the gelatine, the Greenwich bacillus shows a very close resemblance to that well known common putrefactive microbe proteus vulgaris. But on closer comparison it is found that this Greenwich bacillus differs from the proteus in several cultural respects as follows :—

(*a*) Cultures of proteus have a malodorous putrefactive smell, those of the Greenwich bacillus have not.

(*b*) Liquefaction of the gelatine by the proteus organism is less rapid than by the Greenwich bacillus; moreover the aspect of the colonies in gelatine plates is different in the two cases.

(*c*) The proteus organism forms, in broth cultures at 37°C., nebulous fluffy masses; the Greenwich bacillus does not.

(*d*) The proteus organism forms on agar cultures large circular opaque colonies which are white in reflected light; whereas the Greenwich bacillus forms translucent small round colonies, grey in reflected light.

(*e*) On potato the Greenwich bacillus forms both at 20°C. and at 37°C. a thick yellowish layer, whereas the proteus forms a colourless layer under the same conditions.

(*f*) The Greenwich bacillus coagulates milk at 37°C. within 48 hours; the proteus does not coagulate milk.

Certain viscera—liver, spleen, and kidney—of several of the Greenwich fatal cases were, after hardening, examined microscopically in sections. A few bacilli, in size and appearance like those of the intestine described above, were found in the spleen. In the liver none were discovered; but the liver cells in many parts were noted to be in a state of fatty degeneration. In the kidney clumps and streaks of these bacilli were found in the connective tissue between the cortical and medullary portion, extending thence into both cortex and medulla; few of them, however, could be seen in the Malpighian corpuscles of the cortex. These bacilli stained well by Gram's method, and thereby are further distinguishable from the proteus vulgaris.

From the facts that I have recorded, it is to be inferred that the Greenwich bacillus is not the proteus vulgaris, although without doubt it belongs to the same group. There are indeed, several species, or at least varieties, in the proteus group, some of them having distinct pathogenic action on the human subject. Thus Bordoni Uffreduzzi has described* a proteus hominis of pathogenic character, which was derived from rags and which produced in ragsorters a fatal disease chiefly characterised by pneumonic symptoms; and I myself have described in connexion with the Carlisle meat poisoning cases an organism closely resembling the proteus vulgaris.† As regards the pathogenicity of the Greenwich bacillus, I find that subcutaneous injection of guinea-pigs with material from cultures of the microbe, produces local œdematous swellings with general constitutional disturbance, the animals soon becoming quiet and refusing to feed. After two to three days the local swelling diminishes in size and becomes firmer, the constitutional disturbance passes rapidly off, and by the end of a week all traces of the swelling have disappeared. On tame mice the bacillus acts virulently when injected subcutaneously. These animals die within 22 hours, and present about the seat of inoculation an extensive œdematous swelling, in which the bacilli are found in great crowds and whence they are easily recovered by cultivation. The intestines are much congested, relaxed, and full of mucus, which is sometimes bloodstained: the spleen is enlarged and dark in colour; the liver, kidneys, and lungs are congested. Cultivations made of a droplet of the heart's blood of the experimental mouse yield an abundance of the colonies of the bacillus. On feeding mice with cultivations (mixed with bread and milk) no result was produced.

In its virulence on subcutaneous inoculation of small doses into mice, the Greenwich bacillus differs from the proteus vulgaris, since small doses of proteus culture injected subcutaneously into these animals do not produce any such distinct or fatal result.

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* Zeitschr. f. Hygiene, vol. 3.

† Report of the Medical Officer of Local Government Board for 1889–90, p. 223.

ADDENDUM No. 2.

Report by Dr. Klein on the Results of his Examination Bacteriologically of Water Samples from Greenwich Workhouse.

The following samples of water were tested bacteriologically :—

Sample A from tap of Nurse T's. room.
,, B from Workhouse well.
,, C from Infirmary well.
,, D from tap of T ward, east block of Workhouse.

Sample A (From the Nurse's Room).—The following bacteria were isolated from this sample :—

1. A comma bacillus, which in its morphological characters, size, motility, comma, and S shaped forms, did not differ from the cholera vibrio. In cultural characters, however, it differed considerably from that microbe. Thus :—(*a*) It liquefied gelatine faster than the cholera vibrio; (*b*) Its colonies in gelatine plates grew quicker, and were larger than those of the latter; (*c*) In peptone salt solution at 37° C. it grew fairly well, but not so well as the cholera commas; whereas at 20° C. it grew much faster than these; (*d*) On potato it produced after 48 hours, at 20° and 37° C. respectively, distinct growth, but this growth, unlike that of the cholera vibrio, was colourless; (*e*) And, finally, it gave no cholera red re-action. Accordingly I was unable to identify this water comma with Koch's vibrio; and, on the other hand, it differed even more widely from the comma bacillus obtained by me from certain of the Greenwich cases so far as I was able to test the latter microbe.
2. Bacillus proteus vulgaris. This differed from the Greenwich bacillus obtained from the intestinal contents in the same points as does the common proteus.
3. Bacillus coli communis. In plate cultivations made of large quantities of the water* (the residue of 100–250 C.C. of water was used for each plate of phenol-gelatine) a considerable number of colonies of bacillus coli made their appearance.
4. The common bacillus fluorescens liquescens.
5. Bacillus fluorescens putidus.

Sample B. (From the Workhouse well).—Yielded the same species as Sample *A.*, except that this comma bacillus must have been present in less number. In every one of four peptone tubes made of Sample *A.*, this comma bacillus made its appearance, whereas only one out of four tubes inoculated with water *B.* contained it. Bacillus coli was also present in Sample *B.* in fair numbers.

Sample C. (From the Infirmary well).—Yielded bacillus fluorescens liquescens and bacillus subtilis. Also it yielded a motile non-liquefying bacillus which, in its yellow growth and inability to form gas bubbles in gelatine shake culture, differed essentially from bacillus coli.

Sample D. (From the tap in the east block of Workhouse).—Yielded bacillus fluorescens liquescens and putidus, bacillus mesentericus, and non-liquefying cocci.

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* I have given a full account of this method in Appendix C. of Theodore Thomson's report to the Local Government Board on an epidemic of enteric fever in the borough of Worthing and in the villages of Broadwater and West Tarring in 1893 (Eyre and Spottiswoode).

ADDENDUM No. 3.

Water Analysis Laboratory,
The Yews, Reigate, October 24th. 1893.

Greenwich Union Workhouse.

The sample of well water sent to me from this workhouse was turbid from flocculent suspended matter. It contained a large proportion of solid matters in solution and a rather small proportion of organic matter, very little of which was of animal origin. It exhibited very strong evidence of previous sewage or animal contamination, and must, on this account, be condemned as unfit for dietetic purposes. It is very hard and therefore scarcely fit for use in washing.

(Signed) E. Frankland.

Local Government Board.

Results of Analysis expressed in Parts per 100,000.

Number of Sample.	Description.	Solid Total Matters.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen as Nitrates and Nitrites.	Total combined Nitrogen.	Previous Sewage or Animal Contamination.	Chlorine.	Hardness. Temporary.	Hardness. Permanent.	Hardness. Total.	Remarks.
8956	Greenwich Union Workhouse well water, Oct. 17, 1893.	52·60	·116	·019	·034	·945	·992	9,410	3·7	22·3	7·7	30·0	Turbid.

E. Frankland,
The Yews, Reigate.

Water Analysis Laboratory,
The Yews, Reigate, October 31st, 1893.

Greenwich Union Infirmary.

Herewith I enclose results of analysis of a sample of water from the well at the Greenwich Infirmary collected on October 23rd.

Except for its turbidity, this water is of excellent quality for dietetic purposes. It possesses a very high degree of organic purity. Its hardness is about the same as that of the water delivered by the Kent Water Company.

The cause of turbidity ought to be investigated; since, if caused by surface infiltration, the water might become injurious to health although chemical analysis might still show it to be of great organic purity.

(Signed) E. Frankland.

Local Government Board.

Results of Analysis expressed in Parts per 100,000.

Number of Sample.	Description.	Solid Total Matters.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Hardness. Temporary.	Hardness. Permanent.	Hardness. Total.	Remarks.
8973	Water from well at the Greenwich Infirmary 4 p.m. October 23rd.	39·12	·021	·004	0	·429	·433	2·3	20·6	6·0	26·6	Turbid.

E. Frankland,
The Yews, Reigate, Surrey.

ADDENDUM No. 4.

TABLE showing, for the WORKHOUSE INMATES, the DAILY INCIDENCE of ATTACK on each AGE GROUP.

	Males.				Females.				Infants.	All Ages and Sexes.
Groups.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Sex.	Men.	Men.	Boys.	Boys.	Women.	Women.	Girls.	Girls.	Infants.	Totals.
Ages.	16–60.	60 and over.	9–16.	2–9.	16–60.	60 & over.	9–16.	2–9.		
Average Number of Inmates.	154	399	12	15	178	350	8	13	26	1,155
Date. October 1	—	—	—	—	—	—	—	—	—	—
„ 2	—	—	—	—	—	—	—	—	—	—
„ 3	—	—	—	—	—	—	—	—	—	—
„ 4	—	1	—	—	—	—	—	—	—	1
„ 5	—	—	—	—	—	—	—	—	—	—
„ 6	—	—	—	—	1	1	—	—	—	2
„ 7	—	—	—	—	4	8	—	—	—	12
„ 8	1	3	—	—	3	8	—	—	—	15
„ 9	3	26	—	—	7	27	—	—	—	63
„ 10	—	10	—	—	4	17	—	—	—	31
„ 11	3	5	—	—	11	13	—	—	—	32
„ 12	—	3	—	—	1	14	—	—	—	18
„ 13	1	6	—	—	2	7	—	—	—	16
„ 14	2	4	—	—	6	4	—	—	—	16
„ 15	2	4	—	—	3	3	—	—	—	12
„ 16	—	—	—	—	1	5	—	—	—	6
„ 17	—	—	—	—	5	2	—	—	—	7
„ 18	—	—	—	—	—	—	1	—	—	1
„ 19	—	—	—	—	—	—	—	—	—	
„ 20	—	—	—	—	—	2	—	—	—	2
„ 21	—	—	—	—	—	—	—	—	—	0
„ 22	—	—	—	—	1	3	—	—	—	4
„ 23	—	—	—	—	—	—	—	—	—	0
„ 24	—	—	—	—	—	—	—	—	—	—
„ 25	—	—	—	—	—	—	—	—	—	—
„ 26	—	—	—	—	—	—	—	—	—	—
„ 27	—	—	—	—	—	—	—	—	—	—
„ 28	—	—	—	—	—	—	—	—	—	—
„ 29	—	—	—	—	—	—	—	—	—	—
„ 30	—	—	—	—	—	—	—	—	—	—
„ 31	—	—	—	—	—	—	—	—	—	—
	12=7·7%	62=15·5%	0	0	49=27·5%	114=32·5%	1	0	0	238=20·6%
	Total Males attacked, 74=12·7%.				Total Females attacked 164=29·8%.					

ADDENDUM No. 5.

TABLE showing, for the WORKHOUSE, the DAILY INCIDENCE of ATTACK on each DIETARY GROUP.

Class of Diet	Diet No. 1.		Diet No. 5.		Diet No. 4.		Extra Labour Diet.		Mutton.*		Totals.
Sex	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	Including 26 Infants.
Average Daily Number on each Diet	134	156	207	8	13	25	76	60	150	300	1,155
October 1	—	—	—	—	—	—	—	—	—	—	—
„ 2	—	—	—	—	—	—	—	—	—	—	—
„ 3	—	—	—	—	—	—	—	—	—	—	—
„ 4	—	—	1	—	—	—	—	—	—	—	1
„ 5	—	—	—	—	—	—	—	—	—	—	—
„ 6	—	1	—	—	—	—	—	1	—	—	2
„ 7	—	3	—	—	—	—	—	—	—	9	12
„ 8	—	4	—	—	—	1	—	—	4	6	15
„ 9	—	6	9	2	1	1	—	3	19	22	63
„ 10	—	4	3	1	1	1	—	1	6	14	31
„ 11	—	7	4	3	1	1	—	1	3	12	32
„ 12	—	2	2	2	—	—	—	1	1	10	18
„ 13	—	2	4	1	—	—	—	1	3	5	16
„ 14	—	3	2	2	—	—	—	1	4	4	16
„ 15	1	1	2	—	1	—	—	—	2	5	12
„ 16	—	3	—	—	—	—	—	—	—	3	6
„ 17	—	3	—	1	—	—	—	1	—	2	7
„ 18	—	1	—	—	—	—	—	—	—	—	1
„ 19	—	—	—	—	—	—	—	—	—	—	0
„ 20	—	—	—	—	—	—	—	—	—	2	2
„ 21	—	—	—	—	—	—	—	—	—	—	0
„ 22	—	—	—	—	—	—	—	—	—	4	4
„ 23	—	—	—	—	—	—	—	—	—	—	0
„ 24	—	—	—	—	—	—	—	—	—	—	—
„ 25	—	—	—	—	—	—	—	—	—	—	—
„ 26	—	—	—	—	—	—	—	—	—	—	—
„ 27	—	—	—	—	—	—	—	—	—	—	—
„ 28	—	—	—	—	—	—	—	—	—	—	—
„ 29	—	—	—	—	—	—	—	—	—	—	—
„ 30	—	—	—	—	—	—	—	—	—	—	—
„ 31	—	—	—	—	—	—	—	—	—	—	—
Totals	1	40	27	12	4	4	—	10	42	98	238
Per-centage attack on each dietary group.	14·1		18·1		21·0		7·3		31·1		20·6

* As in the first instance, some suspicion attached to the mutton as having been the cause of the outbreak. give here the number of inmates daily consuming that article of diet.

ADDENDUM No. 6.

Report on Result of Post-Mortem Examinations made on:—

Obadiah P., age 74, died 13th October 1893.

William N., age 76, died 15th October 1893.

Michael S. M., age 64, died 15th October 1893.

William C., age 68, died 12th October 1893.

William A., age 78, died 14th October 1893.

M. previously had left hemiplegia, C. had suffered from osteo arthritis, A.'s case was probably one of peritonitis; he had diarrhœa and vomiting with the peritonitis. In all these cases the features presented a pinched look as if the patients had died from some sudden exhausting disease; post-mortem rigidity was present, but not to any marked degree; the brain was normal; the lungs were normal, except in the cases of P. and M., which exhibited signs of old pleuritic adhesions; the œsophagus was normal; the heart was normal, the right side being full of clotted blood. The stomach of each with contents was removed and sealed up in jars. The spleen was normal, the liver was normal, the kidneys were normal, except those of C., which were granular and contained a few small cysts. The small intestines were nearly empty, any contents being a dark colour. The lower portion of ileum was removed and placed in a sealed jar.

The large intestines contained liquid stools, the colour of which was dark. The rectum was normal. The vessels of the intestines were much injected, more especially about the lower part of small intestine and cœcum.

The bladder was nearly empty, only containing a very small quantity of urine.

The peritoneum was normal to the touch and sight, except in the case of A., in which it was acutely inflamed, along with effusion of lymph.

Cause of death exhaustion from repeated vomiting and diarrhœa accelerated by old age.

Walter C. S. Burney,
Medical Superintendent,
Greenwich Union Infirmary.

Report on Post-Mortem Examinations of Female Cases.

Report on post-mortem appearances found in the bodies of Mary A., aged 77 years, died on Tuesday, October 10th, 1893, at 9 p.m.; Mary Ann W., aged 92 years, died 9.15 a.m., October 11th, 1893; Jane C., aged 86 years, died 6.30 a.m., 13th October 1893; Sarah H., aged 68 years, died at 9.30 p m., October, 30th, 1893, after a relapse; Elsie T., aged 65 years, died also of a similar disease; but delay occasioned by informing coroner, who did not order a post-mortem, caused the body to become much decomposed.

The bodies were fairly well nourished considering the great ages of the subjects; post-mortem rigidity was present in all cases, but not to any great extent. The features were pinched in all cases. The brains and their membranes in all cases were normal.

In all cases:—

The *Mouth* was normal.

The *Tongue* was thickly furred.

The *Æsophagus* was normal.

The *Lungs* were normal, except those of Mary A., which presented evidence of old pleurisy and chronic bronchitis.

The *Heart* was normal; the right side was full of blood and the left empty. In the case of Jane C., the walls of the left ventricle were hypertrophied.

The *Peritoneum* was normal; nothing like stickiness was observed.

The *Stomachs* were normal, except that of Mary A., which had three small black patches situated on the anterior wall near the greater curvature; the largest was about the size of a shilling. Contents of all stomachs opened were fluid; most of them were sealed up unopened in jars.

The *Small Intestines* were rather contracted, contents fluid; the colour of the latter varied from pale brown to darkish green.

The *Large Intestines* had liquid contents, the colour of which varied as in the case of the small intestines. The mucous membranes were occasionally a little roughened. In the case of Sarah H. the following appearances were noted:—About the splenic flexure of the colon was a clean cut, nearly circular, ulcer, the size of a three-penny piece, which had nearly perforated the wall of the bowel. From this point and towards the rectum ulcers gradually increased in number; they were most numerous about the upper portion of the rectum, where they nearly surrounded the bowel:

The size of the ulcers seldom exceeded that of a shilling; occasionally they ran into one another; their walls were usually clean cut with very little thickening. They were always situated on the side farthest away from the attachment of the mesentery. Their floors were dark red in colour; the ulcer in the splenic flexure was the deepest of all:

The vessels of large and small intestines were in all cases injected slightly, in some places more so than others; in the case of Jane C., the injection was intense, in that of Sarah H. especially so.

The *Spleen* was normal.

The *Liver* was normal.

The *Kidneys* were normal, except in the case of Jane C., in whom they were cirrhosed and showed small surface cysts.

The *Bladder* was normal; either contracted and empty, or containing one to three ounces of urine.

The Rectum was normal; the only exception being the case of Sarah H. mentioned above.

The *Uterus and its appendages* were normal except in the case of Jane C., whose uterus presented several fibroid tumours, rather larger than walnuts, which had undergone calcareous degeneration.

Portions of liver, kidney, and spleen, together with the stomach and lower portion of ileum, were preserved in sealed jars.

Cause of death: Exhaustion from repeated vomiting and diarrhœa, accelerated by old age.

Wm. J. C. Keats.

ADDENDUM No. 8.

Greenwich Union Infirmary.

Diet Table.

Class.		Breakfast.				Dinner.								Supper.
		Bread. oz.	Butter. oz.	Sugar. oz.	Tea. pints.	Bread. oz.	Meat, oz., or Stew, 1 pt.	Potatoes. oz.	Beef-Tea. pints.	Milk. pints.	Mutton Broth. pints.	Fish. oz.	Bacon. oz.	
1. Ordinary	Males	6	½	½	1	3	5 beef	8	—	—	—	—	4	Same as breakfast.
	Females	4	½	½	1	3	4 beef	8						
2. Mutton	Males	5	½	½	1	3	4 mutton	8	—	—	—	—	and greens in season on Wednesdays.	Ditto.
	Females	4	½	½	1	3	4 mutton	8						
3. Milk and Beef-Tea	Males	5	½	½	1	3	—	—	1	1	—	—	—	Ditto.
	Females	4	½	½	1	3	—	—	1	1				
4. Fish	Males	5	½	½	1	3	—	8	—	—	—	12	—	Ditto.
	Females	4	½	½	1	3	—	8	—	—	—	12		
5. Broth	Males	5	½	½	1	3	—	—	—	1	1	—	—	
	Females	4	½	½	1	3	—	—	—	1	1	—	—	

Stew.—24 oz. of meat in each gallon of liquor in which meat has been boiled, with the addition of mutton bones, 8 oz. of pearl barley, herbs and vegetables in season.

Broth.—½ lb. mutton, 2 oz. pearl barley, vegetables in season to 1 pint.

Beef-tea.—1 lb. beef to a pint.

Rice Pudding.—Rice 2 oz., sugar ½ oz., milk ½ pint, and 1 egg.

Tea to consist of—Tea 2 oz., milk 1 pint, sugar 4 oz. in a gallon.

Jelly, Formula { Gelatine, ʒ i. s.s. (Nelson's). Sugar, ʒ iv. Whiskey, ʒ x. Ess. Lemon / Acid. Cit. } to flavour. Water to make one quart.

Signed,

Medical Officer.

ADDENDUM No. 7.

Greenwich Union Workhouse.

Dietary Scale.

—	No. 1, Able-bodied Inmates of all Ages.												No. 5, Infirm Inmates of all Ages.												Extra Labour Diet.							
	Breakfast.		Dinner.							Supper.			Breakfast.			Dinner.						Supper.			Breakfast.			Dinner.		Supper.		
	Bread.	Oatmeal Porridge.	Bread.	Meat.	Bacon.	Potatoes.	Pea Soup.	Suet Pudding.	Irish Stew.	Bread.	Mutton Broth.	Oatmeal Porridge.	Bread.	Butter.	Tea.	Bread.	Meat.	Potatoes.	Pea Soup.	Suet Pudding.	Irish Stew.	Bread.	Butter.	Tea.	Bread.	Butter.	Tea.	Meat.	Potatoes.	Bread.	Butter.	Tea.
	oz.	pts.	oz.	oz.	oz.	oz.	pts.	oz.	pts.	oz.	pts.	pts.	oz.	oz.	pts.	oz.	oz.	oz.	pts.	oz.	pts.	oz.	oz.	pts.	oz.	oz.	pts.	oz.	oz.	oz.	oz.	pts.
Sunday -	5	1	—	5	—	8	—	—	—	5	1	—	5	½	1	--	4	8	--	—	--	5	½	1	6	½	1		8	6	½	1
Monday -	5	1	4	—	—	—	1½	—	—	5	—	1	5	½	1	4	--	--	1½	—	--	5	½	1	6	½	1	5	8	6	½	1
Tuesday -	5	1	—	—	5	8	—	—	—	5	1	—	5	½	1	--	4	8	—	—	—	5	½	1	6	½	1	5	8	6	½	1
Wednesday	5	1	4	—	—	—	—	—	1½	5	—	1	5	½	1	4	—	—	—	—	1½	5	½	1	6	½	1	5	8	6	½	1
Thursday	5	1	—	5	—	8	—	—	—	5	1	—	5	½	1	—	4	8	—	—	—	5	½	1	6	½	1	5	8	6	½	1
Friday -	5	1	4	—	—	—	1½	—	—	5	—	1	5	½	1	--	4	8	—	—	—	5	½	1	6	½	1	5	8	6	½	1
Saturday -	5	1	—	—	—	—	—	16	—	5	—	1	5	½	1	--	—	--	—	16	--	5	½	1	6	½	1	5	8	6	½	1

Note.—Cabbage is provided on Tuesdays when in season.

No. 4 Diet consists of Milk (1 pint), Beef Tea (1 pint), and Bread (15 ounces).